JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

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(Continued from p. 231.)

WIDTHS AND DEPTHS OF THE ATRATO BETWEEN THE NAPIPI AND QUIBDO, a distance of 85 miles.

After passing the Caño Tadía, five miles above the mouth of the Napipi, a marked improvement is perceptible in the river for some leagues. But from the number of shallow spots which occur at wide places, this circumstance would not be available for the purposes of navigation, unless in conjunction with one of those stupendous systems of engineering which, although easily effected on paper, are never found advisable in practice.

Opposite Tevádа, 14 miles above the Napipi, the river is 300 yards wide; and here my soundings, reduced to extreme low-water, gave a depth of from 18 to 24 feet for three-fourths of the distance across. Although 9 feet above low-water at the time, the river was represented to be at about its ordinary stage for nearly the entire year. This would give for that stage at Tevadá, from 27 to 33 feet for three-fourths of the width. While in this condition, I found the fall to be precisely three-eighths of an inch in 500 feet, or four inches per mile; and the current in the swiftest

part, two and six-tenths of a mile per hour; although in many places above, both the fall and the velocity of the stream were considerably less than this. But at a spot just below the Bojayá, (or 4 miles below Tevádа,) where the river widens to full 400 yards, the deepest low water is 15 feet; and at another spot, 200 yards above the Bojayá, it is but 13 feet. At these points I found respectively, 24 and 22 feet for half the width, the river being at about its ordinary stage, as indicated by our tide-gauge table at the time, and afterwards verified by our observations at Quibdó, for the space of two months.

About 13 feet, therefore, would be the shoalest deduced low-water channel-depth that would necessarily be encountered between the Napipi and the Beté, which is 62 miles above it, or 23 miles below Quibdó.

At the town of Beté, about half a mile below the mouth of the river of the same name, I found the Atrato to be contracted by a gravel bluff to but 620 feet width in its ordinary stages; or a little narrower than at any intermediate point above the Napipi. For one-half this width the extreme low-water depth would vary from 16 to 26 feet, or about 13 feet less than when we sounded in from 29 to 39 feet water, the river being rather high at that time.

The Atrato makes a very sudden bend at Beté, and the current swept strongly around it, especially on the concave side, where I found the fall for a short distance to be at the rate of 19 inches per mile. Nowhere else below Quibdó did I find a rate of fall exceeding 6¾ inches per mile, and that only for short distances in contracted spots. Even at Quibdó, when the river was 18 feet above extreme low-water mark, my level showed a fall of but ·024 of a foot in 515 feet, or about 3 inches per mile, with a current of just 3 miles per hour.

The Beté is an insignificant stream. When we passed it, its mouth was 150 feet wide, but the soundings indicated that in very low stages it must be reduced to a mere run, or gutter, nearly dry; and this was sustained by the Patron and bogas, who had seen it so reduced as barely to admit a canoe.

From some three miles above the Beté, the Atrato rapidly becomes more shallow; and although there are yet many spots below Quibdó having an extreme low-water channel of 8 or 10 feet, still, there are also many where it does not exceed 3 or 4 feet, and that only in narrow, circuitous channels, along which the river boats have to feel their way with care when they happen to encounter one of the short and unfrequent periods of very low stages of water. Sometimes, indeed, although drawing but 3 or 3½ feet, they have been obliged to unload a part of their cargoes into canoes some miles below Quibdó.

Six miles below Quibdó, at a spot called Peñon de Estrélla, the Atrato is contracted from a width of 650 feet to one of 385 feet. On the East, or concave side, is a small isolated hill, perhaps 75 feet high, and consisting of stiff red clay, gravel, pebbles of basalt, &c.; on the west convex side is the levee of mud, leaves, and sand, about 20 feet above low-water. At this place we found the swiftest current we had yet met with, viz.: full 3½ miles per hour. This, I suspect, must be increased to about 4 miles, in very high floods. The spreading of the water on overflowing the levees, would prevent it from being much more than that. My sound-

ings here gave a depth of 24 feet nearly all the way across, corresponding to an extreme low-water depth of 15 feet. At 400 yards below the Peñon, we found 12 feet, and that only for a small part of the width; so that at extreme low stages, the greatest depth at that spot is but 3 feet, while a great portion of the width is nearly dry. The same is the case in many spots between this and Quibdó, as well as at Quibdó itself, where, *for a few days* every year, the river is fordable by boys.

I was assured by several intelligent persons in Quibdó, that the Atrato at that place was not lower than at the time of our arrival, (namely, 11 feet maximum depth,) for more than 30 days in the year; but from my own observations for two months, I have every reason to consider my informants mistaken on this point. Once during our stay the maximum depth was reduced to 6½ feet for three or four consecutive days; and once, to but 5 feet for two days, exposing, on both occasions, sand-bars, logs, &c., in the bed of the river.

The *very uncommon occurrence* of three successive days, with no rain, except trifling showers at night, had immediately preceded, and had produced the lowest of these two stages of water. It is therefore altogether inferable, that a less depth than about 7 feet does not occur at Quibdó for more than thirty days in the year.

The ordinary stages, which we had an opportunity of observing for two months, afforded a good steamboat channel-width, with maximum depths ranging from time to time, between 10 and 16 feet. The fluctuations of the river are incessant, and altogether irregular, except that in every year there occur two periods, each of from two to five weeks in duration, pending which, the river at Quibdó is liable to be reduced to its lowest stages several times, and for some days at a time. These are in June, (sometimes the end of May, or beginning of July,) and in February (sometimes the end of January, or beginning of March.)

The river repeatedly rose or fell, 2, 3, or 4 feet in the course of twelve hours, during our stay; the most sudden risings generally occurring in the night.

The width of the Atrato opposite Quibdó, is 850 feet. The current is about 2¾ miles per hour in the swiftest part of the section when the maximum depth is from 8 to 12 feet; and 3 miles per hour when about 20 feet deep. The latter is the greatest velocity that I observed at any time at Quibdó; and about as great as at any other point above or below, except Peñon de Estrélla, where it was full 3½ miles, and where it doubtless becomes about 4 miles per hour in high floods.

Mr. M'Cann descended the Atrato from Quibdó (in a Carthagena trading boat) by the force of the current only, except a little occasional rowing to avoid running ashore. The time consumed in so doing was 107 traveling hours, by day and by night. This gives for the *average* velocity of the current between Quibdó and the mouth of Caño Coqúito, a mere trifle over two miles per hour, assuming, as I have done, that Quibdó is 220 miles above said mouth.

I regard this as a satisfactory proof that my estimate of distances is very approximately correct. But for the occasional rowing, the velocity of the boat would have averaged probably a trifle less than two miles per hour.

Before speaking more fully of Quibdó, I will recommence at the Napipi, in order to introduce some few points that have been passed over.

Three and a half miles above the Napipi (See Plate VI., Map,) is the little Island of Napipicíto, about half a mile in length, and the first one met with above the bocas, except the Island of Tadiá. A mile above Napipicíto, on the east side of the river, is the southern entrance to Caño Tadiá, which extends to Vigia Curbaradór, enclosing between itself and the Atrato the Island of Tadiá, 42 miles in length. This caño abstracts perhaps one-third of the entire volume of water from the main stream, and thereby materially injures its character for navigation, for that distance.

Ten and a half miles above the Napipi, or 146 miles from the Gulf of Urabá, the River Bojayá (pronounced Bo-ha-yá) enters the Atrato from the west. This stream has been suggested as preferable to the Napipi for the purpose of an inter-oceanic canal. We examined it only for a mile and a half. At this distance from its mouth we found a width of about 100 yards, with a channel varying from 15 to 24 feet in depth, for one-half that distance across. The river was 9 feet above its lowest stage, which occasionally reduces the foregoing depths to 6 and 15 feet, and the width to about 50 yards, for some days at a time. The stream is here bordered by wide swamps, and when the Atrato is a little high, presents quite an imposing appearance as regards width.

The natives occupy five days in ascending the Bojayá in a light potra, to near its head, on their way across to the Pacific. The potra is a very light canoe, frequently but fifteen to eighteen inches wide, and drawing but two or three inches. It resembles a piece of three inch plank hollowed out in trough-shape, and is intended for rapid traveling in very shallow water. We could never even get into one for fear of upsetting it. Mr. McCann, more determined upon success than the rest of us, made three or four desperate attempts, but always got a ducking for his trouble.

The fact that five days are required to ascend the Bojayá, and but two and a half days for the Napipi, appears to militate against the preferableness of the former. The map of Colonel Acosta represents the stream as turning to the south from the direction towards the Pacific, and running nearly parallel to the Atrato for the greater portion of its length; and I was told by natives living at its mouth, that such was the case.

I determined to examine this river, as well as the Napipi, on my return; but my subsequent observations so fully impressed me with a belief in the existence of an insurmountable partition range, between these streams and the Pacific, that I abandoned the intention.

The town of Teváda, (see Plate VIII.,) is situated on the west bank of the Atrato, 14 miles above the Napipi; and, with the exception of Beté, is the only one before reaching Quibdó. At its southern end, is a low, isolated hill, perhaps 100 feet high, at the foot of which is the Church.

The town contains about two dozen tumble-down huts, with the usual walls of cane, and roofs of palm leaves. They all seemed to be going to ruin, without receiving any attention as to repairs. The inhabitants apparently have nothing to occupy them; and their most striking characteristic observable was an intense and unmitigated laziness. Although

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the gritas, or poling cries, of our boatmen must have apprized them of our approach for at least an hour before we arrived, and the advent of a Carthagena boat is quite an event, still not a soul stirred out of his den to look at us, or came on board until we had stopped for more than an hour. Even then, I doubt whether we should have had the honor of a visit, (our boat lying as much as 20 yards from the houses,) had they not learned that the Patron had on board divers demijohns of rum for Quibdó. The very dogs were too lazy to bark at us; but silently regarded us "with one auspicious and one drooping eye," as if doubtful whether to expect a bone, or a kick.

Our efforts to procure supplies here were altogether unavailing, the result of two days' perseverance being rewarded by the purchase only of three eggs. Seeing a few cows and goats straying near the houses, we expected at least to obtain a little milk; but the eternal "no hay," (there is none,) was the reply to all our applications.

Some of those who came on board were diseased to a frightful and most disgusting degree, that effectually deprived me of my appetite for dinner, beside furnishing an unanswerable commentary on the loose state of morals prevalent here.

At Teváda, the boats bound up river generally stop for two or three days, to rest the bogas; and our Patron was not one to violate this time-honored custom.

I availed myself of this delay to devote one day to the River Murrí. This stream enters the Atrato from the West, 1½ miles below Teváda. It heads in the foot of the mountain range known as the Cordilleras Occidentales, or Western Cordilleras. Having engaged a ranchára, or long heavy canoe, and three of our bogas to pole her, we ascended the Murrí about 7 miles, to the town of the same name.

At its mouth it is 100 yards wide; but in many places above it has double that width. At 1½ miles above its mouth, we found it 450 feet, with a depth varying from 12 to 18 feet for one-half the distance across. At low water of the Atrato, however, the width here would be reduced to about 100 yards, and the foregoing depths to 3 and 9 feet. Three miles from the mouth, the width was still 450 feet, but the greatest depth was reduced to 12 feet, which was afforded for half-way across; and at low water would give but 3 feet.

At the town of Murrí, (Plate IX.,) 7 miles from the mouth, the stream, although reduced to but 120 feet in width, has for nearly the entire year water enough for boats as large as that in which we were traveling to Quibdó. Occasionally, however, it becomes nearly dry here, for several days at a time.

As we approached the town, the current gradually increased in force, until for the last half mile, it was a matter of difficulty to pole our ranchára against it. The stream was also beginning to be impeded by sunken trees. Beyond the town, it soon assumes the character of a torrent.

Murrí consists of a dozen poor huts, placed on a perpendicular bluff of clay and gravel, which is high enough to escape the floods of the river. It was nearly deserted at the time of our visit, all its inhabitants, except two or three, having gone further up the river, to wash for gold. This metal is found at the heads of *all* those tributaries of the Atrato which

enter it from the East. These, as well as those of the San Juan, which also furnish much gold, all have their sources in the Western slope of the Western Cordilleras. This range extends uninterruptedly through a great portion of the Republic of New Granada; and in every stream which heads in it, flowing into the Atrato and San Juan, gold is found.

Near the mouth of the Murrí, the levees are of rich vegetable mould; but from 4 or 5 miles above, they gradually change to stiff red and yellow clay, with beds of sand and gravel, intermixed with leaves, logs, &c. The rounded pebbles of the bars and bottom are chiefly of extremely hard basalt, with a small proportion of sienite, porphyry, and other igneous rocks. The bends of the stream are by no means abrupt; and some of its straight reaches afforded pretty views of the Cordilleras of Antioquia, distant perhaps some 30 miles.

While at the town, we searched for the road to Antioquia, which is laid down on the maps; but could not find it. As it is only traveled on foot, and that very rarely, it is probably an undistinguishable forest path.

On our return, the current carried us down to the Atrato in two hours, while our ascent had required four. We saw a few flocks of fine wild ducks, but they did not get within range of our guns.

There are houses built along the banks of the Murrí, at intervals of about half a mile. They are elevated above the levees, like those on the Atrato. The occupants are almost exclusively negroes, by whom clothing generally appeared to be regarded as a very dispensable superfluity.

The day after our return from Murrí being also spent at Teváda, we employed ourselves in rubbing our bodies with various decoctions of brandy and tobacco, red pepper, oil, &c., to allay the intolerable irritation, arising from thousands of *yavís*, which had inserted themselves in our skins, during a few hours' stroll on shore.

The yaví is a microscopic insect of a red color, resembling vermilion dust. I at first mistook it for the pollen of some flower; but on being assured to the contrary, I submitted it to a powerful magnifier, and found it to be apparently a species of tick. The natives do not appear to regard their attacks; but our party having become nearly covered with them, were almost thrown into fevers by the irritation. None of our applications afforded relief, and we found the best thing we could do was to rub the skin from the worst parts, and then apply spirits, for converting the itching into a smart. By this means, we managed to obtain a little sleep, although the greater part of three or four successive nights was passed in pacing the deck, in our shirts only.

About two leagues above Teváda, on the east side of the river, the Atrato has made for itself a *cut-off* across the neck of a great bend. It is called Caño Pacurucundó, and is about 2½ miles in length, with an average width of 50 yards, and a depth of some 10 feet for one-half its width, at low stages. The fall due to the entire length of the more circuitous main stream being concentrated into the shorter length of the cut-off, of course increases the velocity of its current. We found it so strong that with the greatest exertion of the polers, we spent nearly three hours in ascending the first mile; the current would catch our boat as we attempted to cross from side to side of the caño, to avail ourselves of the less velocity at the convexities of the bends, and carry her some distance down

stream before she could be brought up by the paláncas. The boat was frequently pitched headlong into the dense undergrowth of the banks; and floating trees pitched with equal violence into her. The caño is extremely crooked, being worse in this respect than even the Napipi, except that its greater width allows a more ready passage around the bends. The Patron assured us that by taking Pacurucundó instead of the main stream, we saved several miles of distance; but I think it highly probable that this economy of space is tolerably well compensated for by increased expenditure of time and labor.

At one part of this caño, we found the branches of some of the trees completely encrusted with a green insect about an inch long, with a horn on its back. This horn was so hard that it penetrated the soles of our shoes as we accidentally trod on some of them that had been shaken into the boat as we were pitched into the bushes. We took some of them prisoners, and to prevent their escape stuck them into a board by their own horns. A few which I had preserved to bring home were accidentally lost. We saw them nowhere else.

The River Bebará enters the Atrato from the east, 46 miles above the Napipi, and like the Murrí, has its sources in the slopes of the western Cordilleras. At its mouth are some half dozen negro ranchos, and here I detained our boat a day to give me an opportunity to examine the Bebará as far as the town of the same name, a distance of 8 miles. We found it to be about 100 feet wide at its mouth, and varying from that to 150 feet all the way to Bebará; it is shallower than the Murrí, having but 6 or 8 feet at its mouth during the lowest stages, and from 10 to 12 in ordinary ones. At the town it is occasionally nearly dry; but generally affords a boat channel of from 4 to 6 feet deep. Above the town it rapidly becomes shoal, and is much obstructed by fallen trees.

The town of Bebará is situated on a low isolated hillock of clay mixed with large rolled pebbles of basalt; it is a wretched hole, like Murrí, but three times as large, inasmuch as it contains some three dozen huts. One of these is a church.

Here, also, nearly all the inhabitants (chiefly negroes) had gone up the river to search for gold. We made diligent inquiry, aided by actual search, for something to eat, but in vain; two or three lemons alone rewarded our labors. Along the banks of the stream were numerous ranchos, and we noticed far more signs of attention to cultivation than we had hitherto met with. At several of the ranchos we saw large patches of sugar-cane, plantains, and corn. The raw sugar-cane is much used throughout all this region as an article of food, and our bogas bought and ate it with great avidity whenever it was procurable. At some of the huts on the Bebará they were converting it, in small quantities, into molasses, coarse brown sugar, (called panéla,) and guarápo. The sugar, as well as the cane, is held in high estimation as an eatable. Guarápo is the expressed juice of the cane, and, when fresh, affords a quite palatable drink for a hot climate. When first made, it does not intoxicate, but after having undergone fermentation, it does so very effectually, although requiring tolerably copious libations for that purpose. On this account it constitutes an essential element in the merry-makings of the natives, by whom ardent spirits are seldom attainable. A death in a family, espe-

cially, is solemnized by most devout drinking and dancing on the part of the relatives of the dear departed. Guarápo performs important functions in these ceremonies; and I have frequently thought, while contemplating the marvellous effects of its inspirations, "blessed are they that mourn."

We stopped at two or three of the ranchos, to enable our bogas to purchase cane, sugar, and guarápo; and were uniformly received with that simple-hearted kindness that so generally characterizes these people. In their rude huts, provided with an earthen pot or two for cooking, a few calabashes to serve for plates and other utensils, a few gaudy handkerchiefs or pieces of calico, to attach to whatever part of their persons happens to comport with the taste of the lucky possessor on holiday occasions, they live happy and free from care; to-morrow is left to provide for itself, and to-day does not fare much better.

The playas, or bars of sand and gravel, exposed when the Bebará is low, showed considerable quantities of black ferruginous sand, the invariable accompaniment of gold dust. Along the banks of the stream we noticed beds of firm clay, several feet in thickness, overlying deep layers of dead leaves and branches. Near the town some of the clay banks were so indurated as to constitute a semi-rock.

As on the Murrí, our ascent occupied four hours, and our descent two. About a mile below the mouth of the Bebará, in the Atrato, is the Isla del Ingles, or Englishman's Island. I could not learn whence it had derived its name. It is about half a mile long, by 150 yards wide, pretty well cultivated, and liable to overflow.

Twenty-three miles below Quibdó, is the town of Beté, on the west bank of the Atrato. It contains nearly 40 huts, built in an irregular, straggling manner, on a somewhat singular bluff of clay and gravel, which is in some parts as much as 50 feet above low water. This gravel is the first we have seen along the banks of the Atrato.

Taking warning from our experience in Tevádа, we did not indulge in a stroll here; but occupied ourselves in measuring the width of the river, leveling its fall, &c., during which we several times sunk almost to our middles in the soft black mud of the banks. We lay at Beté all night, on board our boat, as usual. The inhabitants seem, like those of Tevádа, to be a dead-alive kind of mortals. No sounds of life or merriment were heard by night at either place; two or three lights might be seen burning in the town, but the deep silence was disturbed only by the agonizing groan of a bull-frog, the chirp of a katy-did, the splash of a falling tree, the mutterings of thunder, or the vigorous snoring of our bogas. These lay, every night, stretched out on the bare deck, each completely enveloped in his blanket, even to his head, insensible to heat, rain, or exposure of any kind. Some 10 miles above Beté, a little fine gravel on one of the sand playas, or bars, was the first we had seen *in* the river; but before reaching Quibdó, the grating of the paláncas on the bottom indicated large quantities of coarse gravel and rolled pebbles.

Quibdo.—At last, on Saturday afternoon, July 10th, turning a bend in the Atrato, we suddenly saw, within a mile of us, the long-desired, the much-talked-of Quibdó. A mere glance sufficed to put a most effective extinguisher upon any preconceived ideas we may have entertained of its

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splendor, or even comeliness; for a view more tame, uninteresting, and destitute of the picturesque, than it presented, cannot well be imagined. —(See plate X.)

Our disappointment at its unpretending exterior did not, however, prevent us from regarding Quibdó with very especial favor. For just one month, (it seemed like six,) had we been toiling up the Atrato, at an average rate of between 7 and 10 miles per day; almost daily exposed alternately to the fierce rays of a tropical sun, and the thorough drenchings of tropical rains; deprived of almost every element that ministers to ordinary comfort, or even to the requirements of common decency; literally "cribbed, cabined, confined" in an oven, the heat of which was scarcely endurable, and reeking with that villanous compound of smells which codfish, semi-putrid jerked beef, unearthly cheese, and other odorous abominations of the cargo exhaled day and night; sleeping in shape of a note of interrogation on a piece of thin floor-matting, spread over the loose boards of the cabin floor, and shared in common by roaches, whose name was legion; tormented almost into sickness and fever by insects of microscopic dimensions, but of gigantic biting powers; constantly drinking warm water from the river, mixed with the frightful rum of the country, (most appropriately called "mata búrro," or "kill donkey;") eating our meals in a cabin three and a half feet high, where we were constrained to assume the most uncomfortable positions; and where our eyes were generally regaled with the smoke from the cook's fire, or offended by hind-shortened views of our black cook himself, perfectly naked, sitting in the entrance to our cabin, perhaps paring his toe-nails, picking his teeth with one of our forks, or vigorously scratching his well-populated head over our stereotyped dessert of boiled rice.

In a word, we were tired out; patience of ten-Job-power had been nearly exhausted; we longed for rest; and in the prospect that within an hour we should attain it, we were already forgetting our privations, when suddenly our boat brought up under full headway on a gravel bar, from which the efforts of the bogas for some hours were unavailing to remove her.

Fortunately, a passing canoe carried the tidings of our mishap to Quibdó, and a ranchada was despatched for our party by Lieut. Porras, who had been our fellow passenger as far as Tevada. At that point he had, for greater expedition, hired a ranchada, and had already arrived in Quibdó some days before us. I should gladly have followed his example, but as my object was to examine the river, I had to give the preference to the most slow and tedious mode of traveling.

As evening was approaching when the ranchada arrived, Dr. Halsted and myself determined to remain on board all night, and proceed with our boat next day; but Mr. McCann started off at once, in order, if possible, to secure a house, cook, &c., for our stay in Quibdó. He succeeded admirably, having hired a new house, just finished, one of the most commodious and pleasant in the town, beside being built on the very brink of the river's bank, thereby enabling us at all times to watch our tide-gauge from the balcony without even leaving the house. Owing to his promptness we were enabled to take possession immediately on our arrival early next morning, a rise in the river during the night having floated our boat out of her difficulty.

The position of our house was the more gratifying, as I had determined to remain at Quibdó long enough to observe the Atrato well in all its phases. We also needed recruiting before commencing our further examinations, which were to extend over some hundreds of miles, and be conducted in small canoes, in comparison with which our large river boat, bad as she was, might be regarded as a floating palace.

We had scarcely been installed in our quarters an hour, before we received a visit from Señor Nicomedes Contó, Governor of the Province of Choco, accompanied by Dr. Key, a Scotch physician, who has for many years resided here, exercising the double calling of physician and merchant. We had brought letters of introduction to both from Carthagena, and I record with sincere gratitude, that during our stay at Quibdó we received from both the most unremitting kindness, and every attention that the dictates of hospitality could suggest. Grateful as such evidences of good will are at all times, they become doubly so when, as in our case, one finds himself literally and emphatically a stranger in a strange land. They at once insisted upon sending to our house such articles of furniture as we most needed; and from them chiefly, I derived such items of information respecting the commerce of Quibdó, and other particulars, as will be found in the following pages.

For some two or three days after our arrival, we felt but little disposition to move about, having become quite stiff by the constrained positions which we had been so constantly compelled to assume during our month's voyage up the river.

Although we had all partaken fully of these inconveniences, still the greater burden fell on myself. From the time of starting, every morning at sunrise, until that of stopping for the day, at sunset, I had been standing, day after day, and week after week, exposed alternately to the sun and rain; the top of the cabin my table, taking the bearings and estimating the distances by eye, as a partial check upon our calculations by time and the rate at which our boat moved.

Dr. Halsted repeatedly proffered his services to relieve me from this fatiguing routine; but although he could have performed the duties as well as I, still, my desire to attend to all I could personally, generally prevented me from accepting his offers. On some few occasions, however, actual prostration by the heat compelled me to take an hour's respite in the cabin, where the temperature very rarely exceeded 95° Fahr.; although it reached 90° or 92° almost every day. At such times I gladly availed myself of the Doctor's assistance.

The sufferings sometimes endured from the direct rays of the sun, aided by the reflection from the water, (which latter scorched our faces in spite of our broad brimmed straw hats,) may be imagined, when I state that the thermometer in the sun repeatedly rose to over 130°, and a few times to 137°. The one which I employed outside of the cabin, was graduated only to 137°, although the range of the mercury extended a trifle above that limit. One day this instrument burst by the expansion of the mercury.

Had it not been that the prevalence of mists and clouds obscured the sun for a great portion of the time, frequently rendering the temperature delightful to persons as lightly clad as we usually were, I should have

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been compelled to abandon the work of noting down the bearings and distances along the river. We could not put up an awning on account of the overhanging branches of the trees and shrubbery which were continually sweeping our deck, filling it with stinging ants, and other insects.

Very frequently we could only endure the scorching heat of the deck floor by throwing water over it at short intervals; and our guns, which lay on top of the cabin, in readiness for snakes or ducks, were kept cool enough for handling by shading them with a piece of canvas.

To be Continued.

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*Railroad and Steamboat Accidents Compared.**

The following table from the New York *Herald*, gives all the railroad and steamboat accidents which have occurred from the 12th of January, 1853, to date:

DATE, 1853	RAILROADS.			STEAMBOATS.		
	Accidents.	Killed.	Wounded.	Accidents.	Killed.	Wounded.
January,	14	25	40	4	66	33
February,	6	6	11	1	120	—
March,	14	24	57	3	30	17
April,	4	25	54	3	58	21
May,	8	54	48	00	00	00
June,	5	5	19	4	19	17
July,	11	8	22	1	7	2
August,	14	35	94	2	2	5
September,	18	13	35	3	8	14
October,	19	14	34	4	18	23
November,	19	11	32	3	19	10
December,	8	7	37	3	13	16
Total in 1853,	138	227	483	31	359	158
DATE, 1854.						
January,	21	10	26	8	139	20
February,	20	12	37	5	54	24
March, to date,	11	13	78	4	148	23
Total during 14½ months,	190	268	624	48	691	225

From this table we gather that the number of accidents upon railroads has been 396 per cent. in advance of those upon steamboats. The number of wounded upon railroads has been 270·07 per cent. in advance of those from steamboat accidents. While the number of deaths resulting from steamboat accidents is 260·50 per cent. more than upon railroads.

From this it would appear that railroad traveling was more prolific in accidents, but less serious in deaths, than steamboat traveling. But there is an element entering into this calculation which is not given here; we mean the respective number of passengers, without which it is impossible even to approximate a general average.

* From the Cincinnati Railroad Record, April 6, 1854.

AMERICAN PATENTS.

List of American Patents which issued from March 7th, 1854, to March 28th, 1854, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

MARCH 7.

1. For an *Improved Arrangement of Fusible Plugs or Disks for Steam Boilers;* Wm. Burnett, Boston, Massachusetts.

"The nature of my invention consists in a peculiar arrangement of plugs or disks of fusible alloy, which insures that they will melt with great certainty and accuracy, and by which the difficulties found in the use of such plugs or disks, as generally applied, are obviated, viz: liability to be forced from their seat, by the pressure of the steam, before the fusing point is actually arrived at, and also from being exposed to a high temperature, the great liability to have the more fusible metal of the compound, forced, by the pressure of the steam, out of the interstices of the metal combined with it, leaving a porous metal which is not easily fused, and therefore unable to perform its intended function."

Claim.—"I do not claim the application of fusible plates to steam boilers for the purpose of permitting the steam to escape when it has reached any assigned limit; nor do I claim the method described, of preventing the plate, which is remote from the boiler, from being fused by the heat of the boiler. What I claim is, the application to steam boilers, of two plates or plugs of fusible alloy, arranged as described, one of said plates being remote from the boiler, and the other to the interior thereof, by which arrangement the pressure of the steam is admitted on both sides of the interior plate, in the manner and for the purposes as specified."

2. For an *Improvement in Machines for Plastering;* Isaac Hussey, Harveysburgh, O.

Claim.—"What I claim is, the arrangement of the several parts of the machine, substantially as and for the purpose described."

3. For an *Improved Arrangement of Valve Motion for Locomotive Engines;* Caleb Cook, Nashville, New Hampshire.

Claim.—"I do not claim, for operating the valves, an arrangement, wherein a link is employed, and has attached to it the valve rod and the eccentric rod, the centre pin of the link working in the eye of a horizontal arm attached to a rocker shaft; nor do I claim a modification of such, wherein would be the same link with the eccentric rod and valve rod attached, and having the centre pin of the link moving in vertical or curved guides, attached to the rocker shaft, as such modifications do not admit of the reversing of the engine, without the removing both the link and the eccentric rod, whereas, with my improvement, such can be effected by moving the eccentric rod only. I therefore limit my claim to my particular arrangement or construction of the open lever, as provided with two recesses, and connected to a rocker shaft, and applied to, and made to operate with respect to the eccentric and valve rods, substantially as described."

4. For an *Improvement in the Gauge of Straw Cutters;* W. Gale, Louisville, Ky.

Claim.—"What I claim is, the arrangement of the adjustable gauge, as described."

5. For an *Improved Method of Opening and Closing Gates;* Wm. G. Philips, Newport, Delaware.

Claim.—"What I claim is, the double span rotating gate, opening and closing, continually formed by means of levers and inclined planes, as well as by pulleys and cords, combined and arranged as set forth."

6. For an *Apparatus for Rounding and Beveling Barrel Heads;* Joel P. Heacock, Marlborough, Ohio.

Claim.—"What I claim is, rounding and beveling a barrel head at one operation, in a very true and perfect manner, by the employment of a double-edged adjustable cutter, secured in a swinging frame, or forked lever, and moved from a vertical to a horizontal position, vice versa, back and forth from one end of the staff to the other, in combination with the clamping jaws for holding the stuff in a proper position by being operated upon, substantially as set forth and described."

7. For an *Improvement in Cotton Seed Planters;* George W. Cooper, Palmyra, Ga.

Claim.—"What I claim is, the combination of the saws and feeders, the said saws having a reciprocating rectilinear motion, and the said feeders having a reciprocating rotary motion, the above parts being constructed and arranged substantially as set forth."

8. For an *Improvement in Sash Fasteners;* Henry B. Kimble, Rochester, New York.

Claim.—"I am fully aware that a weighted lever has been used to move a sliding and independent bolt; I do not, therefore, claim the simple combination of the weighted lever with the sliding bolt; but what I do claim is, the combination of the peculiar form of the bolt, having the locking notch with a weighted lever, formed and operating substantially in the manner described."

9. For an *Improvement in Sewing Machines;* William H. Johnson, Granville, Mass.

Claim.—"What I claim is, 1st, The making of a seam with a single thread, by the combination of a single needle, forked hook, and expanding lever, operating substantially in the manner and for the purpose specified. 2d, The forming or making of a seam from a single thread by the running of a loop of the thread through the material to be sewn, the running of a second loop through the material, and putting the first loop through the second, the running of a third loop through the material, and through the first named loop, the carrying of a fourth loop through the material, and putting the third through it, and so on, putting the first loop through the second and around the third, the third loop through the fourth and around the fifth, and so on, forming the belaying double loop stitch described, in the manner set forth. 3d, The feeding of the material to be sewn, by means of a vibrating needle, by which the material is moved along, as required, for the stitch, substantially in the manner specified."

10. For an *Improvement in Sash Sustainers;* George C. Hinman, New Haven, Conn.

Claim.—"What I claim is, the sash sustainer, consisting of an arched rod attached to the horizontal part of the window in such a manner that the weight of the sash shall cause the clogged ends of the rod to bear equally on both sides. And, also, the above described lever thumb piece for increasing the arch of the rod, and relieving the pressure so as to allow the window to be lowered, the whole being arranged and operated substantially as described."

11. For an *Improvement in Reeling Machines;* George Levan, West Earl Township, Pennsylvania.

Claim.—"What I claim is, the double disk, as constructed with hinged wing, for the purpose of keeping the threads regularly stretched, and operating the sliding rail when one of the threads is broken, in the manner described."

12. For an *Improvement in Sectional Dry Docks;* Samuel Loveland, Astoria, N. York.

Claim.—"I am aware that a water ballast has been used, extending from stem to stern of a life boat, for the purpose of righting the same; and I am also aware that space between separate floats is not new; but what I claim is, the transversely placed tank, trunk, or water chamber of each section of the dock, forming not only a central water ballast in the float directly under the keel of the vessel, but when empty, a dry tank, for the purpose of giving access to the keel in repairs. I also claim the tank, trunk, or chamber, in combination with the buoyant chambers or floats, hollow guards or chambers, or when combined with the chambers or floats attached to the ends of the trunk or float, in the manner set forth."

13. For an *Improvement in Tail Stocks for Turning Lathes;* L. B. Tyng, Lowell, Massachusetts.

Claim.—"What I claim is, constructing and applying guide boxes, substantially as described, to the tail stocks of lathes, which make a better, cheaper, and far more durable bearing than those made heretofore for such purposes."

14. For an *Improvement in Machines for Boring and Mortising Carriage Hubs;* R. J. R. Stone, Berlin, Ohio.

Claim.—"What I claim is, the combination and arrangement of the chisel and quadrant lever, in the manner specified, for the purpose of beating out the mortise at any desired angle, as indicated by the index. I claim this in connexion with the sliding frame, in the manner and for the purpose set forth."

15. For an *Improvement in Carriage Brakes;* Joseph Sollenberger, Higginsport, O.

Claim.—"I claim the mode of applying the fore and hind wheel rubbers, by means of the connexion applied to the fore rubber, as described, and in connexion therewith, the connexion applied to the hind rubbers, as described, so that the fore wheels may be acted on in the rear, and the rear wheels in front, substantially in the manner and for the purpose described."

16. For an *Improvement in Apparatus for Paying the Seams of Vessels;* James W. Stoakes, Milan, Ohio.

Claim.—"What I claim is, the construction of a rotary mop by the combination of the two sectional disks, provided with hollow arms or axes, through which passes a bolt having a nut, by which the disks are secured together, and the mop retained in place at the periphery, between the inside edges, or by any other means substantially the same, for the purpose set forth."

17. For an *Improvement in Suspending Eaves Troughs;* Chauncey D. Woodruff, Toledo, Ohio.

Claim.—"What I claim is, the mode of suspending and fastening eaves troughs, as described."

18. For an *Improvement in Seed Planters;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"What I claim is, constructing the driving wheels of planters with cut rims and divided hubs, substantially as described, said hubs being made to traverse the driving shaft, by means of forked levers, operated by a screw, or its equivalent, for regulating the aligment of the hills in a cross direction. I also claim the scraper, in combination with the pins and levers, arranged and operating substantially as described, for preserving a given space between the edge of the scraper and outer surface of the rim of the wheel."

19. For an *Improvement in Seed Planters;* Jeremiah C. Gaston, Reading, Ohio.

"My improvement consists in the peculiar construction and operation of a reciprocating agitator in the hopper, for the purpose of preventing the clogging of the seed, and to insure its discharge."

Claim.—"What I claim is, the reciprocating agitator, constructed and operating in the manner and for the purposes set forth."

20. For an *Improvement in Sewing Machines;* Charles Miller, St. Louis, Missouri.

Claim.—"What I claim is, giving the cloth or material being sewed, a movement laterally to the directions of the seam between the successive stitches or interlacings of the needle and shuttle threads, substantially as set forth, for the purpose of receiving different kinds of stitches or seams."

21. For an *Improved Method of Operating Hydraulic Rams;* Clark Polley, May's Landing, New Jersey.

Claim.—"I do not claim, in any manner, the pump or hydraulic ram; but what I do claim is, the air tight box or chamber, having within it, and in combination therewith, and with each other, substantially as set forth, the hydraulic ram and pump, and having suitable pipes attached, in such manner as that when the apparatus is submerged and the pump worked from above, the ram will be free to operate by the pressure and momentum of the water resting above it."

22. For an *Improvement in Artificial Legs;* David B. Marks, City of New York.

"My invention relates to the means by which the movements of the knee and ankle joints are controlled, and the necessary rigidity is maintained during the cessations in those movements."

Claim.—"What I claim is, the combination of the rod which is attached to the foot, and moves upwards and downwards, with the leg or lower part of the limb, the spring applied to the rod, and the curved bar, plate, or way, attached to the thigh or upper part of the limb, the whole operating, substantially as described, to lock the knee stiff, and control the position of the foot until the ankle is bent on throwing the body forward, and retain the foot in its bent position at the ankle until the knee is again straightened."

23. For an *Improvement in Brick Machines;* Seman C. Ripley, City of New York.

Claim.—"I do not claim, broadly, the use of a gauge for guiding the moulds in entering under the grating, as such a gauge, provided with a weighted lever for throwing it

back to its place on the backward movement of the force bar, has been used in the machine of Collins B. Baker, patented March 26th, 1850; but what I do claim is, throwing the gauge back to its place by means of a tail or cam, or the equivalent thereof, upon which the force bar acts on its backward movement, substantially as described."

24. For *Improvements in Machines for Splitting Ratans;* Joseph Sawyer, South Royalston, Massachusetts.

Claim.—"What I claim is, the combination of the feed rollers with the cutter, constructed and operating as described."

25. For an *Improvement in Machines for Splitting Ratans;* Addison M. Sawyer, Templeton, Massachusetts.

Claim.—"What I claim is, the employment of a tubular spurred cutter, or its equivalent, in combination with a guide for holding and guiding the stick thereto, substantially as described."

26. For an *Improvement in Sewing Machines;* William Wickersham, Boston, Mass.

Claim.—"I do not claim the mere duplication of a sewing machine, or the placing of one of such machines by the side of, or near to, another and similar machine, so as to perform two rows of stitches by the operation of both machines. But what I claim consists more properly in so combining with one sewing machine, having one needle and a thread carrier, or their mechanical equivalents, another or second needle, and a second hole in the thread carrier, or the equivalents therefor, that by the action of the same needle-moving machinery, two needles are made to operate simultaneously, so as to perform at one and the same time, two parallel rows of stitches with separate threads, substantially as specified."

27. For *Improvements in Britannia Tea and Coffee Pots;* Robert W. Andrews, Staffordville, Connecticut.

Claim.—"What I claim is, a tea pot, coffee pot, or other vessel composed of a supporting ledge, or base of iron, (or other metal which is not melted by ordinary degrees of fire heat,) combined with a body of britannia metal, substantially in the manner and for the purpose set forth."

28. For an *Improvement in Connecting the Joints of Air Heating Pipes;* J. Young, Franklin Furnace, Ohio.

Claim.—"What I claim is, forming a perfectly tight joint for air heating pipes, by boring out recesses in the ends of the pipes, the recesses being sufficiently large to receive a thimble, which is made of a more expansive metal than the pipes, and which thimble, upon being heated, will, in consequence of expanding more than the pipes, bind tight against the recesses in which it is fitted, and form a perfect tight joint, as shown and described."

29. For an *Improvement in Machines for Drilling Stone;* William C. Wright, Boston, Massachusetts.

Claim.—"What I claim is, the combination of mechanism described, for operating the drill bar, consisting of two pairs of grippers, attached to rods having slotted heads which receive the wrists of the cranks, the said cranks being arranged diametrically opposite to each other on a common axis, and the slots in the heads of the gripper rods being of such form as described, so as to cause one set of grippers to be always rising while the other pair are descending, but to cause a cessation of motion before every descent, in order to give time for the drill bar to fall."

30. For an *Improvement in Hanging Gates;* Ashley Hotchkin, Schenevus, N. Y.

Claim.—"What I claim is, hanging a gate by means of two lower turning pivots or pintles, working on separate step projections of a box or frame, the upper end of the gate being steadied and carried by rollers, (any suitable number,) or their equivalents, working or traveling in fixed rows, chambers, or spaces, so as to admit the gate opening either way; the several parts being constructed, arranged, and operating essentially for the purpose expressed, as described."

31. For an *Improvement in Water Closets;* Daniel Ryan and John Flanagan, City of New York.

Claim.—"What we claim is, 1st, Dividing the chest or penstock into two compartments,

communicating with each other, the division being made by means of a flanch, or its equivalent, by which a sufficiency of water is reserved within said chest or penstock, after the supply has been stopped, to cover the opening or mouth of the pipe at the bottom of the bowl seat, and effectually prevents the escaping of effluvia into the apartments. 2d, The sliding tube within the trunk or cylinder, said tube being constructed, arranged, and operated, as shown, by which a direct communication is at all times cut off between the bowl seat and exit pipe, and, at the same time, the excrement allowed to pass into the exit pipe at the proper time."

32. For an *Improvement in Self-Acting Railroad Switches;* Joseph Wilson, Hartford, Connecticut.

Claim.—"I do not claim the connexion of a switch and a bar by a jointed lever, so that the motion of one gives a corresponding motion to the other; nor do I claim to operate the switch by means of a bar forming part of one of the main track rails; nor do I claim to return the switch to its position by means of a spring and catch, after it has been displaced by the pressure of the flanch of the car wheel, but I limit my claim to the precise arrangement of the parts for operating the switch by means of the lateral pressure of the wheel flanches on the inner sides of the movable and fixed rails, when the cars are on the rails."

33. For an *Improvement in Sewing Machines;* Christopher Hodgkins, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"What I claim consists in constructing the horizontal needle of the angular form, substantially as described, and making it to operate with respect to the vertical needle and its eye, arranged as set forth, essentially in the manner as specified."

34. For an *Improvement in Wire Heddle Eyes for Looms;* Thomas Clegg, Assignor to himself and Nathaniel Stevens, Andover, Massachusetts.

Claim.—"I do not claim a loom harness metallic eye, or eyelet, made by being stamped out of a piece of metal; nor do I claim a metallic eye or heddle, formed by round wires, or wires twisted together. But what I do claim is, a loom harness metallic eye, made of round wire, or wires twisted together, and compressed and flattened in the twist of its wires, and directly at the top and bottom of its warp thread opening, substantially in the manner and for the purpose as described."

MARCH 14.

35. For an *Improvement in Rotary Cultivators;* George B. Field, St. Louis, Missouri.

Claim.—"I claim the construction of the rotary cultivating cylinder, made of cutting plates or spades, and interposed pushing or clearing boards for removing the earth, as described. I claim the arrangement of the shield plates, on the shaft, for the purposes set forth. I claim the arrangement of the rotary harrow, sustained above the ground, and in the rear of the cultivating cylinder, for breaking and pulverizing the falling earth, as set forth."

36. For an *Improved Saw Set;* Oliver Lesley, Attica, Indiana.

"The nature of my invention consists in the arrangement of a triangular gauge, admitting of adjustment or movement, in connexion with a swage, provided with a suitable nick or recess for receiving the tooth of the saw, in its process of sharpening and turning, while the gauge regulates the turn or hook of the tooth thus operated on; both of these devices being secured on a stock or handle, by which the implement is held when in use."

Claim.—"What I claim is, the arrangement of the triangular gauge with the swage upon the stock, for the purpose of adjusting the gauge relatively to the nick or recess in the swage, as set forth."

37. For an *Improvement in Excluding Dust from Railroad Cars;* Orrin Newton and J. A. Crever, Pittsburgh, Pennsylvania.

"Our invention consists, chiefly, in ventilating railroad cars by supplying them, when in motion, with a continuous current of atmospheric air, previously purified from dust and other foreign matter, whereby not only is the car thoroughly ventilated, but the ingress through windows and crevices in the cars, of dust, sparks, insects, &c., from outside, is prevented by the current of air which is thus caused to rush constantly out of the cars, the reverse of which is the case when the cars are not thus artificially supplied with air."

Claim.—"What we claim is, the combination of the bellows and water cistern con-

nected with each other, and with the cars, by pipes, for the purpose of ventilating railroad cars, constructed and operating in the manner described."

38. For a *Machine for Damping Printing Paper;* Andrew Overend, Philada., Pa.

Claim.—"What I claim is, 1st, The self-acting feed-board, arranged and operating as described. 2d, The arrangement and combination of the upper and lower felted rollers, for the purpose of saturating the upper roller in the intervals between the passage of the paper, in the manner substantially as described. 3d, The projections, for the purpose of breaking the bead as the paper enters, arranged and operating substantially as described. 4th, The combination of the wetting cylinders and fly, substantially as described."

39. For an *Improvement in Form of Scythes;* Joseph W. Robinson, Kirkland, N. Y.

Claim.—"What I claim is, the form which is given to the back and web of the scythe, as described, whether the web starts from the centre of the back, or elsewhere, except from the edge."

40. For an *Improvement in Mould-Boards of Ploughs;* Edwin M. Bard, Philada., Pa.

"The object of my improvement is, to break or pulverize the layers of earth at the same time that they are cut and thrown over by the mould-board, and cause the ground, when ploughed, to be thoroughly softened the full depth (or nearly so) of the cut of the plough, and, in fact, enable the plough, in its progress through the field, to perform the two offices of plough and harrow."

Claim.—"I do not claim the combination of cutters or rakes with cultivators or ploughs, for enabling the latter to perform two functions at the same time; but what I do claim is, securing the cutters in openings formed in the mould-board at the points, and in the inclined positions, outward and backward represented, so as to enable the lower forward cutters to cut and loosen the soil preparatory to its being overturned on the other cutters, to more thoroughly pulverize it as the body of earth is thrown over, and the cutters, from their peculiar inclined position, to disengage themselves from weeds and other obstacles as they pass the same, the several parts being precisely as described."

41. For an *Improved Method of Constructing Moulds for Making Printing Blocks;* James Berry, Roxbury, Massachusetts.

Claim.—"It is proposed to extend this invention to the production of cylinders as well as blocks, and also to set the types for the moulds by machinery, from which a great saving of labor will result; but this forms no part of my present invention; neither do I claim making blocks for printing by casting them into suitably prepared moulds; nor do I claim making blocks for printing woolen or other fabrics, by setting up movable types, and thus producing the requisite figures to be subsequently printed from; but what I do claim is, forming the moulds in which to cast printing blocks of types or prisms, in the manner described, and for the purpose set forth, by which I am enabled to produce a great variety of patterns at a very small cost, and in a comparatively short space of time."

42. For an *Improvement in Machines for Making Shovel Handles;* Russell D. Bartlett, Bangor, Maine.

Claim.—"I claim the combination and arrangement of the bed, the rotary holder, one or more vertical movable cutters, and one or more stationary cutters, as made to operate together and form the D or head part of the shovel handle, substantially as specified. And I claim the combination of the curved knife and the arc knife, so applied together as not only to allow them to be separated for the purpose of being ground, but to enable them to cut out the opening of the shovel handle, as specified. And I claim the combination applied to the shaft of the rotary holder and gear wheel, for the purpose of operating the holder, as specified, the said combination consisting of the cam blocks, the arm, the spring bolt, and the two studs, the whole being constructed and made to operate together, substantially as specified."

43. For an *Improvement in Seed Planters;* Charles W. Billings, South Deerfield, Mass.

Claim.—"What I claim is, linking, or otherwise equivalently attaching the pulverizing gauges to the draft bar in such a manner that the gauges are raised or lowered to regulate the depth of furrow to be cut, by elevating or depressing the draft bar to its proper pitch or height for the draft at a given depth of furrow, and whereby the draft bar and gauges are simultaneously raised or lowered, essentially as set forth. I also claim the combination and arrangement of the vibrating seed segment slides, geared together by

cogs or teeth on their peripheries, and operating in unison, as set forth. I likewise claim the manner of pivoting or jointing the vibrating segments at their centres of motion, by constructing the jointing pin with projecting ears or lips, and forming the joint hole of a key-hole shape, as described. I further claim, in combination with seed distributing slides, the employment of the double-acting spring clearing slides, arranged so as to be capable of lateral movement in either direction, and made self-adjusting to their original position, substantially as and for the purposes specified."

44. For an *Improvement in Faucets for Measuring Liquids;* Joshua Cross, New London, Ohio.

Claim.—"What I claim is, the construction and arrangement of a measuring vessel, and the valve of a faucet, substantially as described."

45. For *Movable Tapering Nozzles to the Exhaust Pipes of Locomotives;* Frederick Espenchade, Mifflintown, Pennsylvania.

"The nature of my invention consists in applying as many short movable pipes or nozzles, contracted to different sizes, as it is desirable to have variations of draft, which nozzles are severally brought over the discharge orifice of the exhaust pipes by any convenient means under the control of the engineer, whenever he may desire to vary the draft."

Claim.—"I am aware that various contrivances have been combined with the usual immovable conical nozzle of the waste steam pipe of locomotives for the purpose of enabling the engineer to vary the draft in the furnace, and therefore I limit my claim to the employment of movable tapering nozzles of various sized orifices, so arranged that either of the said nozzles may, at will, be brought over the mouth of the waste steam pipes, to vary the draft in the furnace of the locomotive, substantially as set forth."

46. For an *Improvement in Spring Clamps for Clothes Lines;* E. S. Haskins, Boston, Massachusetts.

Claim.—"I do not claim uniting the two parts of a clothes pin by a hinge, and closing the jaws by introducing a spiral or other spring between the opposite ends of the levers; but what I do claim is, the combination of the barrel, the groove, and the elastic band of india rubber, or other suitable substance, by which means the different parts of the clothes pin are held together securely, by the same spring which closes the jaws, instead of requiring a separate device for the purpose, as has heretofore been the case."

47. For an *Improvement in Machines for Dressing Stone;* Elbridge G. Hastings, Brooklyn, New York.

"The nature of my invention consists in the employment of a cylindrical cross-head, by which the ways or guides which carry and give direction to the motion of the tool stock are supported in front, and on which they turn freely, and of a tool stock to which the cutting tool is attached, having in its lower side a recess, corresponding more or less nearly to the curvature of the said cross-head, which said cross-head thus serves also as a rest or stop, at whatever angle the said ways or guides may be adjusted, and determines always the depth of the cut, and causes a perfectly true surface to be produced on the stone."

Claim.—"What I claim is, making the cross-head of cylindrical form, and the tool stock with a corresponding concavity, substantially as shown, so that the ways or guides which carry and give direction to the motion of the said tool stock, turn freely on the said cross-head, and the said cross-head serves as a rest or stop at whatever angle the said ways or guides may be adjusted, and thus always determines the depth of the cut, and causes a perfectly true surface to be produced on the stone."

48. For a *Process for Gilding or Plating Fibrous Substances;* Albert Hock, Rue de Grenelle, Paris, France; patented in France, Dec. 15, 1852.

"This invention consists in coating silk or other thread or yarn, tapes, or bands, with gold, silver, or other metal leaf, by first coating a cylinder or roller with the metal leaf intended to be used, and then winding thereon the silk or thread, or yarn, which is to be coated, after which metal leaf is to be laid on to the surfaces of the silk thread or yarn which has been wound on the cylinder or roller, when, by pressing the metal leaf with dry cotton, the silk or thread or yarn will be coated with the metal leaf."

Claim.—"What I claim is, the process, substantially as described, of coating silk (whether organzine, train, or twist,) and thread or yarn, (of silk waste and thread,) or yarn of cotton (or other fibres or mixtures thereof) with gold, silver, or other metal leaf."

49. For an *Improvement in Faucets for Measuring Liquids;* J. B. Lawrill and J. Cross, Bucyrus, Ohio.

"The nature of our invention consists in a simple and useful manner of constructing faucets, whereby they are made capable of measuring any given quantity, and of shutting off the supply from the cask, simultaneous with the discharge of the same from the faucet, and vice versa, when it is desired to measure another quantity, and susceptible of being speedily converted into a constant runner, when desirable."

Claim.—"What we claim is, the manner described of constructing faucets, whereby they are rendered capable of measuring any given quantity, and of shutting off the supply from the cask when it is desired to discharge the contents of the faucet, and of closing the discharge of the faucet when it is desired to measure a fresh quantity, and susceptible of being converted into a constant runner, when desirable."

50. For an *Improvement in Metallic Grummets for Sails;* Eldridge H. Penfield, Middletown, Connecticut.

Claim.—"I am aware that metallic grummets have been made with two parts, one being composed of a disk, or rim, and a cylindrical tube, and the other part of the disk or rim only; and also, that they have been made of two parts, where one of the parts was like the first, and the other part made similar, except that the tube was made with 'teeth or points,' as described in a patent issued to me, Sept. 19, 1848. I therefore do not claim either of these methods, as such, as my new invention; but what I claim is, the making of the metallic grummet of three or more pieces of metal, raised to the proper shape, when the several parts are constructed and arranged, substantially as described."

51. For an *Improved Stop Cock;* Orson C. Phelps, Boston, Massachusetts.

Claim.—"What I claim is, the flanch, in combination with the conical plug, constructed and operating as described, for the purpose set forth. 2d, I claim the air cushion within the plug, constructed and arranged in the manner and for the purpose substantially as described."

52. For an *Improved Faucet;* Ezra Ripley, Troy, N. Y.

"The nature of my invention consists in adjustable clamps or jaws, combined with a faucet tube, for the purpose of opening and closing, at pleasure, the discharge orifice on one side of the tube."

Claim.—"What I claim is, the adjustable clamps or jaws, in combination with the faucet tube, for the purpose of closing and opening the discharge orifice when drafting or drawing fluids, constructed and operating substantially in the manner and for the purpose as described."

53. For an *Improvement in Rotary Engines;* Gerard Sickels, Brooklyn, New York.

"This invention relates to a method of making and maintaining a perfectly tight fit between the cylinder and the revolving head which carries the pistons or sliders, without the aid of packing; and is applicable to rotary engines, with variously constructed and arranged pistons. It consists in making the revolving head with a flanch on one side only, which flanch has its inner face fitting to a suitable surface within the cylinder, while that face of the main portion or hub of the head opposite the flanch, fits close to the bottom end of the cylinder, and admitting steam to act on the sides of the revolving head, thereby packing up the head to the cylinder."

Claim.—"I do not confine myself to the particular construction, arrangement, or manner of operating the pistons, as described, nor to the form of the working faces of the revolving head and cylinder; but what I claim is, the method described, of making and maintaining a perfectly tight fit between the ends of the cylinder and the revolving head which carries the sliders or pistons, by admitting a pressure of steam outside of the flanch of the revolving head, substantially as set forth."

54. For an *Improvement in Machines for Grinding Cotton Cards;* Nathaniel Smith and Asa Crandall, North Kingston, Rhode Island.

"The nature of our invention consists in the employment of a narrow emery roller, made to traverse back and forth on a horizontal right and left or endless screw, from one end of the card cylinder to the other, and simultaneous therewith to describe vertical circles, and thereby caused to operate in a parallel line with the carding cylinder upon the whole face of the card, and gradually and effectually grind the teeth of the same to a perfect uniformity in length, and give them the proper finish."

Claim.—"What we claim is, a narrow emery card grinder, carrying a weighted forked lever or shifter, and keyed loosely on an endless or right and left screw, which, in combination with the forked lever or shifter, gives a continuous back and forward traverse to said grinder, and serves also as a shaft for it to hang and move upon while grinding the cards, the whole being constructed, arranged and operating essentially as and for the purpose described."

55. For an *Improvement in Seed Planters;* Welcome Sprague, Ellicotsville, N. Y.

"The nature of my invention consists in so constructing this seeding machine, that the several operations of making the dibble or receptacle in the soil, conveying the seed from the hopper or reservoir, delivering the same therefrom, and with certainty ensuring its conveyance and deposit in the earth, shall all be effected by the most simple and economical arrangement of mechanism, and that without a single cog or gear, by the mere rolling over of the wheel on the earth, as in a common drill barrow."

Claim.—"What I claim is, the combination of the hollow hub or grain reservoir with the tubes, piston, and rods, operated by the cam grooves, or its equivalent, on the diaphragm, the whole arranged in the manner substantially as set forth, for the purpose of insuring the deposit of the seed in the soil."

56. For *Hanging of the Griping Jaw of Spike Machines in Weighted Levers;* James H. Swett, Pittsburgh, Pa.

Claim.—"What I claim is, the so hanging of the griping jaw in weighted levers, or their equivalent, as that when two spikes, or a spike and a blank, comes in between the griping jaws at one time, the said jaw may rise and yield to the excess of metal between the dies, and prevent the breaking of any of the parts, substantially as described."

57. For *Improvements in Rotary Cultivators;* Philander Shaw, Abington, Mass.

Claim.—"What I claim is, the method of hanging and operating the spades, they being applied in one or more vibrating sets to a rotary frame, each spade being hinged to the frame and made to turn through the sector of a circle, and provided with stops and a stud to act against a stationary cam, as described; the whole being applied together, and to a carriage or frame, and made to operate so as not only to dig into and raise earth, but to perform the office of impelling along on the ground the whole machine, substantially as specified."

58. For an *Improvement in Steam Engine Faucet Valves;* Abijah Taylor, Pekin, Ill.

Claim.—"What I claim is, my peculiar valve, constructed, adapted, and arranged in such manner as to perform the functions of a safety and pressure valve, as described."

59. For *Improvements in Folding Blinds;* Mansel Blake, Assignor to himself, James B. McAlestee, and Erastus Blake, Sutton, New Hampshire.

Claim.—"What I claim is, the arranging a series of slats on one set of the parallel bars of a folding frame of parallel and crossed bars, so that the slats shall not only extend from end to end of their several bars, but be made to overlap one another, and thereby, in connexion with the folding frame, form a folding blind or shutter, made to operate as specified."

60. For an *Improvement in Obstetrical Supporters;* Westel S. Daniels, Panama, N. Y.

Claim.—"What I claim is, extending the thigh straps across the top of the knees, and arranging them to run through rings, or their equivalents, where they are connected with the knee and feet straps, so that they may be seized by the hands of the user, and drawn up to increase, or slackened to graduate, the pressure of the back pad against the back, as desired, without changing the position of the body, legs, or feet, substantially as described."

61. For an *Improvement in Smut Machines;* Lewis Fagin, Cincinnati, Ohio.

"The nature of my invention consists in a vertical machine, combining on one shaft a smut and scouring apparatus, capable of ejecting the smut, chaff, &c., from wheat before scouring it for flouring purposes, and also of retaining the scattered grains, and returning the same into the scouring department again, and thoroughly scouring the whole with the least liability to break the wheat, so that it becomes pearled to a considerable extent before it finally passes out at the place of delivery."

Claim.—"What I claim is, my method, or its substantial equivalent, of arranging a blowing apparatus, where the upper or suction fan takes the air at the centre, and discharges on the periphery, to precede, on the same shaft, a scouring mill, for the purpose of taking from grain the smut, chaff, &c., before the scouring process is commenced, and

afterwards thoroughly scour the same, thus constituting the cleansing and scouring processes the duty of a single machine, substantially in the manner and for the purpose described. I also claim the cylinder, hopper, and feed pipe, as arranged, or their equivalents, and for the purpose described. I also claim the collar, as arranged, and for the purpose described. I also claim the guide, as arranged, and for the purpose described. I also claim the scouring cones, severally and collectively, with their circular and horizontal grooves and perforated terraces, or their equivalent, and in combination with the conical fan and beater, substantially as described, and for the purposes enumerated."

62. For an *Improvement in Securing Window Sashes;* Alpheus Kimball, Fitchburgh, Massachusetts.

Claim.—"I do not claim confining window strips or beads, by letting them into mortises in the top and bottom of the frame, as this has been done before; but what I do claim is, confining window sashes by means of strips which are raised into deep mortises in the top of the frame a sufficient distance to enable them to be dropped into shallow mortises at the bottom of the frame, the strips being held against the sashes by the pressure of a screw, or other analogous device, in the manner described. 2d, The method of securing and tightening the sashes by means of pressure upon the exterior of the sash strip, whether it be produced by screw, in the manner described, or by any other analogous device."

63. For an *Improvement in Grain Harvesters;* Dan. S. Middlekauff, Hagerstown, Md.

"The nature of my invention consists in constructing a machine for the purpose of cutting grain, and leaving it in gavels or sheaves suitable for binding."

Claim.—"What I claim is, 1st, The rotary knives or cutters, the edges of which pass by each other for the purpose of forming a continuous edge for the purpose of cutting the grain. 2d, The reels and the spring catch and projection on the wheels, in combination with the apron, for the purpose of supporting the grain in an inclined position, in the manner and for the purpose described."

64. For an *Improvement in Machines for Drilling Stone;* Simon Pettes, City of N. Y.

"The nature of my invention consists in constructing one for drilling rock, &c., of an exceedingly portable character, and by the arrangement of the operative parts, giving certainty of action in the turning of the drill head, thus obviating the liability to jamb or deface the lifter, while, at the same time, the diagonal rib on the face of the lifter serves the purpose of a greater throw than one placed radially from the shaft on which the lifter turns."

Claim.—"What I claim is, so placing on the sliding frame the windlass with ratchet, whose pawl is acted on by the drill head at each descent thereof, and thus feeds the entire mechanism as the work proceeds, substantially as set forth."

65. For an *Improvement in Processes for Making Varnishes;* Jonathan Burrage, Roxbury, Assignor to J. Burrage and F. W. Newton, Newton, Massachusetts.

Claim.—"I am aware that the exudations from the pinus canadensis and pinus picea, (which exudations are respectively known in commerce by the names of 'Canada balsam' and 'Venice turpentine,') have been mixed with essential oil, or spirits of turpentine, in the manufacture of varnishes; I therefore do not claim such mixtures as forming any part of my invention; nor do I claim the employment of sulphate of zinc, litharge, or magnesia, in an oil for the purpose of imparting drying qualities thereto; nor do I claim, in making a varnish, the employment of a virgin turpentine, or that which is in the natural and liquid state it has when it exudes from the tree, but as, by exposure of the crude or natural liquid turpentine of the 'pinus abies,' or 'pinus silvestris,' to the action of air and light for several weeks or months, it becomes hard and brittle and decolorized, and otherwise changed, or has its essential oil evaporated, and is otherwise purified of much that is objectionable in varnish, and, in fact, becomes another, or highly improved article for the manufacture of varnish, and as such has never, to my knowledge, been used in making varnish, but only in the composition of plasters, or for other purposes in medicine, and in calico printing, and some other arts, it being known in commerce by the names of 'gum thust' or 'gum sass.' I claim as my invention, the above described process or mode of making varnish, viz: by combining gum thust or gum sass with the essential oil of turpentine, and treating the mixture substantially as specified."

66. For an *Improvement in Seed Planters;* J. G. Macfarlane, Perry County, Penna.

"My invention consists in the employment of a self-acting slide or scraper, working over the feeding apertures for preventing more than the proper number of grains from

falling to the furrow at each hill; also, in the use of a hanging scraper, by which the groove of the wheel is always kept clean, so as to be in condition for facilitating the operation of the wheel."

Claim.—"What I claim is, the combination of the action of the levers, cams, spring, and the weight of the scraper to clean the wheel."

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67. For an *Improved Machine for Distributing Type;* Victor Beaumont, City of N. Y.

Claim.—"What I claim is, 1st, The combination, called distributing channel of the channel sides, lever, and slide, with two springs, lever, and rod, or their equivalents, substantially as described. 2d, The combination of distributing and receiving channels with disk, ring, and eccentric shaft, or their equivalents, by which the distributing and receiving channels are brought into contact along a curve, the last element of which curve is perpendicular to their faces of contact, substantially as described."

68. For an *Improvement in Grain and Grass Harvesters;* Henry Green, Ottawa, Ill.; ante-dated September 21, 1853.

"The nature of my improvements consists in arranging the sickle bar so as to operate a proper distance in advance of the sickle stock, and traversing it in blocks fastened to said stock, making a space in the rear of the sickle teeth, which are extended back behind the bar, and sharpened so as to cut off any grass, stalks, &c., which may collect between the sickle bar and stock. Also, in constructing the carriage and connecting the sickle stock to it in such a way and manner that the stock travels parallel with the ground, accommodating itself to the undulations of the surface, while the rear end of the carriage travels so high as to clear the grass, grain, etc., cut at a previous swath."

Claim.—"What I claim is, 1st, The V-shaped space or zigzag shape of the rear of the sickle teeth, or the equivalent thereof, the angles of which press the substances back which collect upon the fingers and prevent them from clogging the sickle. 2d, Extending the rear ends of the sickle teeth back behind the sickle bar, whether made as represented in the drawing, or broader, or extended back to a point. Also, sharpening said rear ends so as to cut off any stalks, grass, etc., which may collect upon the fingers between the sickle and the stock. 3d, Terminating the sickle stock at the inside of the rail, and fastening them together, substantially as described, thereby permitting the sickle and stock to travel near the ground, and parallel with it, while the rear end of the carriage is carried so high as to clear the grass or grain cut at the previous swath."

69. For an *Improvement in Compounds for Extinguishing Fires;* Ralph Bulkley, City of New York.

"The nature of my invention consists in providing a ship or a building with an aperture, which aperture is to be used when the ship or building is internally on fire, for inserting a composition of matter that will burn under any circumstances, and produce a predominant smoke, so vapid in its nature as to extract the oxygen from common air, vapor, or steam, and render every æriform therein inert, and quickly thereby extinguish flame, embers, and coals of fires, in any part, apartment, or apartments thereof."

Claim.—"I am aware that a patent has been obtained for a composition of sulphur and nitre for producing 'sulphurous acid gas' for extinguishing flame; but I contend that the composition of vegetable and mineral matter described, for producing a vapid smoke, comprises a patentable difference from all other improvements therefor. What I claim is, the application to ships and buildings of a composition of fossil and vegetable substances which will transmute, by the action of fire in close places, and produce a predominant smoke that will extinguish common fire, as described, using for that purpose the aforesaid compound, or any other substantially the same, and which will produce the intended effect."

70. For an *Improvement in Machines for Rubbing Type;* Daniel Moore, City of New York, Assignor to George S. Cameron, Charleston, South Carolina.

"The nature of my invention consists in the use of a supply plate, from which the type are thrown by centrifugal force through a gutter or trough, on to a conducting plate, that by an elastic roller supplies the type to a series of rotary fingers that carry the type, first, over a stone or similar rough surface, that takes off any small burs or feather edges that in getting into the cutters might cause the type to deviate from its course; next, the type is carried through between a series of two or more cutters that successively remove the sides of the type, and the burs thereon, the type passing finally between brushes which

clean or remove from the type the fibres or shavings of metal that have been cut from the type, and leave it ready for use."

Claim.—"What I claim is, 1st, The centrifugal supply plate, combined with the conducting plate by means of the channel, or its equivalent, to pass the type as specified. 2d, The elastic roller, moved by the pinion and spur wheel, to separate the types, as specified. 3d, The stones, or similar cutting surface, to operate first on the type, as described. 4th, The use of two or more pairs of cutters, the lower ones being connected by the bridges to remove the projections and rub the type, as specified. 5th, The brushes to clear the type prior to delivery from the machine, in the manner specified. 6th, The means shown, consisting of the ring and screw nut, for changing a whole set of the fingers, according to the thickness of type to be rubbed, as specified."

71. For *Improvements in Safe Locks;* F. C. Goffin, City of New York, Assignor to A. B. Ely, Boston, Massachusetts.

Claim.—"What I claim is, the arrangement of the sectors in such manner that a part of the number shall have the portions above the slots of a radius greater than the rest, so as to project beyond the other sectors, and with smooth peripheries, substantially in the manner and for the purpose set forth. The arrangement of slot holder and notch holder, with the sectors, by which, while the former engages with all the sectors, the latter engages with those only that have not a smooth periphery, substantially as described. The arrangement of the slot holder, or slot and notch holders and their catches, with the slotted, or slotted and notched sectors, in relation to the key hole, substantially as described."

72. For an *Improvement in Iron Safes;* Obadiah Marland, Boston, Massachusetts.

Claim.—"I do not claim the lining of safes with soap stone, independent of the means of attaching it to the outer plate or shell, and of protecting it from breaking, as this has been done before; but what I do claim is, the combination of a lining of soap stone, or other suitable material, with the internal protecting plate on the inner surface of the door, when the said lining is constructed in the manner described, so as to dispense with any metallic connexion between the outer metallic casing and the internal surface of the door, whereby I am enabled to avoid the heat of conduction passing from the outer to the inner surface of the safe, as set forth."

73. For an *Improved Machine for Dressing Spokes;* R. P. Benton, Rochester, N. Y.

Claim.—"Having obtained a mode of making a constantly varying cross section in the shape of a spoke with a single pair of cutters, in which is given a rotary, a lateral, and an oscillating motion; what I claim is, the arrangement producing these different movements, as described, viz: the shafts, frame, carriage with its grooves, elbow lever, and bolt, or their equivalents."

74. For an *Improvement in Lifting Jacks;* Jermy W. Bliss, Hartford, Connecticut.

Claim.—"What I claim is, the combination of the toothed cams, with the lifting frame or slide, arranged and operating together as and for the purposes set forth, when the said cams are so constructed at their finishing extremities as to form a bearing surface on either side of the centres of the axes of the cams, whereby the jack is made self-setting, and is restrained from flying from its set, as specified."

75. For an *Improvement in Processes for Dyeing;* Chas. T. Appleton, Roxbury, Mass.

Claim.—"I do not intend to limit myself to any particular machinery for the purpose of producing the reciprocating motion of the cloth, as this forms no part of my invention, and a great variety of machinery may be employed for the purpose, which may be actuated either by hand or other power. And I do not intend running the cloth through the machine from end to end, and back and forth, as has heretofore been practised in machine and hand dyeing; but what I do claim is, communicating to the goods while in the vat, a reciprocating motion back and forth, of at least double the distance from the upper rollers to the surface of the liquor, so as to insure the immersion of the whole material once for each vibration, by which means I am enabled to give the whole of the fabric any required number of dips, and to interrupt the operation at the instant the desired shade is attained, as set forth."

76. For an *Improved Hydraulic Engine;* Augustus C. Carey and Jeremiah Smith, Ipswich, Massachusetts.

"The nature of our invention consists in having two horizontal trunks, water chambers,

or cylinders, provided each with a valve and piston. The p'stons have adjustable or movable heads, and the ends of the piston rods are secured to connecting rods or levers, which are attached to reverse cranks on a shaft, having a gear wheel upon it, from which gear wheel the power is taken. The water from the flume is made to act by means of the valves in the trunks, chambers, or cylinders, first against one piston, and then against the other, and a continuous rotary motion is given the crank shaft. The water in the trunks, chambers, or cylinders, after acting against the pistons the length of the stroke, is let out by the operation of the movable heads."

Claim.—"We are aware that hydraulic engines have been previously used, but differently constructed from ours; we do not claim pistons attached to a crank shaft, and working by the force of the water alternately in trunks or cylinders, for the purpose of applying water power to the propelling of machinery; but what we claim is, the peculiar arrangement of the valves and piston heads, as described, viz: the piston heads being movable or hung upon centres, and opened and closed by means of rods acted upon by pins or studs at each end of the strokes of the pistons, the valves being opened and closed alternately, by means of the pins on the crank shaft acting against the arms, by which arrangement the water is permitted to act, not only alternately upon the pistons, but also allowed to escape from the trunk or cylinders when the water has forced them along within the trunks or cylinders, the required distance or length of stroke."

77. For an *Improvement in Screw Wrenches;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"What I claim is, making the wrench with a split or double shank, a movable jaw to embrace and slide on the shank, and a tapering screw, or its equivalent, applied to the shank, so as to be capable of separating the two parts of the shank, and thereby clamping the movable jaw in place on the shank, all substantially as specified."

78. For an *Improvement in Concaves of Clover Hullers;* Thomas Carpenter, Manlius, New York.

"The nature of my invention consists in substituting cards, such as are used in carding wool, &c., in place of the teeth and other devices in common use for the same purpose, and which latter are objectionable in breaking the seed."

Claim.—"What I claim is, the manner set forth, of threshing or clearing the hull from the berry of clover seed, viz: by passing the seed between two cards, as described, one of the cards being attached to the surface of a cylinder, and the other attached to a concave surface, so that the wires of the cards are in contact, the cylinder being revolved, while the concave is stationary, the hulls are rubbed off without danger of cracking the seed; the whole constructed substantially as described."

79. For an *Improvement in Dredging Machines;* Charles H. Fondé and Thomas B. Lyons, Mobile, Alabama.

Claim.—"We do not claim the wheel with the buckets or scuppers across its periphery; nor do we claim the means of revolving said wheel, or the means of elevating or depressing the same, with the view of increasing or diminishing the depth of earth caught by the scuppers; but what we do claim is, a tilting tipper applied to a dredging wheel, said tipper dropping within the outer circumference of said wheel, so as to be in a position to receive the mud discharged from the buckets, as set forth. Also, the arrangement for causing the tipper to tilt out of the way for the full buckets to pass and return again to its position to receive the mud discharged, and for keeping the tipper in gear with the wheel, so that it will always perform its duties, notwithstanding the difference in their relative positions when raising and lowering the wheel. We further claim the combination of the latch or dog with the ledge of the bed plate of the bucket, by means of which the bucket is adjusted and held firm while digging and raising the earth, as set forth."

80. For an *Improvement in Grain Threshers;* J. L. Garlington, Snapping Shoals, Ga.

"The nature of my invention consists in threshing grain in a more perfect manner than has ever been done before, by the employment of a vertical revolving, adjustable springing disk, having a series of beaters, set tangentially to its axis, around its face, and another series placed radially round its periphery, in combination with a stationary concave, having a series of stationary strippers, arranged tangentially on the inner face of one of its sides, directly under the passage where the grain is fed in, and another series of strippers, placed radially, for a short distance round its inner periphery."

Claim.—"What I claim is, the employment of a vertical adjustable and springing disk, made elastic by means of a spring bearing against the end of its shaft, and adjustable by set screws, which pass through the ends of the spring, and throw it into action to a

greater or less extent, according as they are turned, and having a series of beaters set tangentially to its axis around its face, and another series placed radially round its periphery, in combination with a stationary concave, having a series of stationary strippers, arranged tangentially to the axis of the revolving disk on the inner face of one of its sides directly under the passage where the grain is fed in, and another series of stationary strippers placed radially for a short distance round its inner periphery, the whole being constructed, arranged, and operating in the manner set forth, for the purpose of effecting the objects specified in the foregoing description."

81. For an *Improvement in Nippers for Printing Presses;* Charles W. Hawkes, Boston, Mass.

Claim.—"What I claim is, the device for removing the sheet from the form after the impression has been given, substantially as set forth. 2d, I claim the nipper frame, constructed in the manner as described, and for the purpose specified."

82. For an *Improvement in Harvesters;* Philip H. Kells, Hudson, N. H.

"This invention consists in so placing the knife frame that the bar to which the cutting blade is attached shall be in a range with, and perpendicular to, the side of the guiding roller, when the axis of that roller is parallel to the axis of the driving wheel."

Claim.—"What I claim is, laying the bar which carries the cutting teeth ranging with the guide roller, and perpendicular to its side face, when the axis of said roller is parallel to the axis of the driving wheel, for causing the cutter bar to conform to the surface of the ground passed over, and for the prevention of accidents to the cutting teeth, as set forth, said bar being on the gearing side of the machine."

83. For an *Improvement in Railroad Car Wheels;* Jordan L. Mott, City of N. York.

Claim.—"I do not claim the making of hollow railroad wheels, that is, wheels with two plates connecting the hub and rim; nor making wheels with separate hubs for the two plates; but what I do claim is, making railroad wheels with the outer face of any of the usual forms, in combination with the inner plate, of a conical or nearly conical form, connected with the axle towards the middle of its length, to brace the rim of the wheel to resist lateral thrusts, and greatly reducing the liability, if not entirely avoiding the breaking or bending of the axle, all substantially as specified."

84. For an *Improvement in Self-Fastening Shutter Hinges;* Ambrose Nicholson, Poland, N. Y.

Claim.—"I do not claim locking the shutter by its up and down motion, that being a common device; but what I do claim is, the eccentric extension and recess of the plate, in combination with the pin of the plate, by which, in connexion with the elongated eye and cylindrical pin, I am enabled to move the shutter and catch it or release it, without giving it any upward or downward motion, as set forth."

85. For an *Improvement in Machines for Dressing Mill Stones;* J. G. Shands, St. Louis, Missouri.

Claim.—"What I claim is, placing the wiper wheel which operates the arbor and pick, on a swinging frame, as described, by which a greater or less length of vibration may be given the arbor, and the pick be made to act with a corresponding degree of force upon the stone."

86. For an *Improvement in Devices for Preserving Hen's Eggs in the Nest;* C. V. Ament, Dansville, New York.

Claim.—"What I claim is, constructing a hen's nest with two peculiarly constructed and arranged chambers, which communicate with each other through a hole in the centre of the nest, and self-adjusting false bottom under the same, the upper chamber being provided with a suitable nest, and a number of false eggs for the hen to set upon, and the lower one is provided with a soft cushioned surface for the eggs to fall upon, which is made of such shape that the real eggs, as they escape through the false bottom, are caused to roll gradually towards the edge of the bottom, and remain there until removed, the whole being constructed and arranged in the manner and for the purposes described."

87. For an *Improvement in Anti-Friction Boxes;* David A. Morris, Pittsburgh, Pa.

Claim.—"I do not claim the employment, for the purpose of causing the rollers to revolve simultaneously and uniformly, of spur gear teeth on axle, several friction rollers,

and interior of the box, as that is covered by the claim of Joseph Harris, Jr., of Feb. 28, 1848; but what I claim is, furnishing the series of anti-friction rollers at one or both ends, or at any part of their length, with a series of toothed wheels, one for each, and an endless chain, substantially as and for the purpose described."

88. For an *Improvement in Dyeing Apparatus;* Charles T. Appleton, Roxbury, Mass.; patented in England, Jan. 7th, 1854.

"My invention consists in passing the material to be dyed over the surface of a perforated cylinder or tube, the dyeing liquor being forced into the tube, and out at the perforations in the same, through the body of the cloth, which is passed through the machine from one roller to another, and is made to press tightly upon the surface of the cylinder, fine streams of dyeing liquor from the perforations passing through it in such quantities as may be requisite, and displacing and forcing out the globules of air with which the pores of the goods may be filled."

Claim.—"What I claim is, the described machine or apparatus for the purpose of dyeing, to wit: the combination of the perforated cylinder, constructed as described, with the force pump, or its equivalent, operating in the manner substantially as set forth."

89. For an *Improvement in Belt-Saws;* David A. Cameron, Butler, Pa.

Claim.—"What I claim is, 1st, The application of the lever and movable frame to tighten the saw, and to keep it always uniformly tight, in the manner set forth. 2d, The sliding collar on the cylinder, or drum, with adjusting screws, by which the saw is brought forward, and made to project beyond the edge of the drum; and, 3d, The conical pins placed in the drum, when constructed and used in the manner and for the purposes set forth."

90. For an *Improvement in Shoe Lasts;* Thomas Dougherty, Erie, Pa.

Claim.—"I do not claim the mere construction of a last of wood and metal; but what I do claim is, the construction of a last consisting of a metallic shell or casing, inclosing wood placed endwise upon the sole, and having soft metal pieces upon the sides of the last, for the purposes set forth."

91. For an *Improvement in Machinery for Making Barrels;* George W. Livermore, Cambridgeport, Massachusetts.

Claim.—"What I claim is, 1st, Forming or shaping the staves previous to jointing them, by passing them through a series of pairs of curved rollers, in the manner set forth. 2d, The peculiar construction of the carriage of the jointing machine, the bar being made adjustable within the long slots or mortises, in the manner set forth. 3d, The combination of the cone with the spring drivers, operating as described, for the purpose of guiding the hoop to the barrel, and driving it into place, in the manner set forth."

92. For an *Improvement in Portable Metal Punches;* Samuel McKenna, Cincinnati, Ohio.

Claim.—"I do not claim the invention of the punches, the dies, or lever and eccentric, as a means of applying pressure; but what I claim is, the arrangement, for a portable punch, of the tongue, connected jaws, stirrups, punches, dies, lever, and eccentric, as described."

93. For an *Improvement in Seed Planters;* David Wolf and Herman Wolf, Lebanon, Pennsylvania.

Claim.—"What we claim is, the combination of annular revolving perforated plates, with curved grooves on the underside thereof, constructed substantially in the manner and for the purposes described."

94. For an *Improvement in Machines for Jointing Staves;* Alexander Wilbur, Lancaster, Pennsylvania.

"The nature of my invention relates to the method of jointing staves of variable widths, each with its requisite bilge, without adjusting the machine, it having a self-operating adjustment for each and every width. Also, in combination with the swing frame, in which the stave is presented to the cutter wheel, the guides which move with it, for the purpose of holding the edge of the stave being dressed firmly to the wheel of cutters."

Claim.—"What I claim is, so hanging the swing frame which feeds up the stave to the jointing wheel, as that staves of variable widths may be dressed with the bilge necessary for said widths, substantially as described. Also, in combination with the swing frame,

the guides which move with it, for the purpose of firmly holding the stave to the jointing wheel or cutters, substantially as described."

95. For an *Improvement in Crozing Machines;* Alexander Wilbur, Lancaster, Pa.

Claim.—"What I claim is, so combining the crozing tool with the cutter head, as that said crozing tool may be thrown into or out of operation, whilst the cutter head continues its rotation, by means of the centre pin, or its equivalent, substantially as described."

96. For an *Improvement in Quartz Crushers;* Herman Gardiner, City of New York; patented in England, July 5th, 1853.

"The nature of my invention consists in making and using an oblong chilled cast iron trough, arranged in a suitable frame, and having on the side rails of the trough frame reversed inclined planes, so as to give a winding rolling motion to a heavy cast iron ball in the trough, as it is made to roll backwards and forwards by means of a connecting rod attached to a crank, and driven by any suitable power, for the purpose of making a machine for crushing and pulverizing earths, quartz rock, or other substance containing any of the precious or baser metals."

Claim.—"What I claim is, the crusher trough, having on each side rail reversed inclined planes, for the purpose of giving the ball, as it is propelled backwards and forwards in the trough, a twisting motion, substantially as set forth."

97. For a *Rotary Smoothing Iron;* Jeremiah W. Brown, Hartford, Connecticut, Assignor to Samuel M. Folsom, Charlestown, Massachusetts.

"The nature of my invention consists in the peculiar form and make of the same. The body or smoothing part of the iron I make with two or more faces, to revolve on an axis at each end passing through the stems of the handle, so that when the lower face, which is in use, becomes cooled in operation, and requires heating up again, I can, by merely taking out a pin, or some other equivalent, turn the upper part down to take the place of the lower face when cooled in working."

Claim.—"What I claim is, the revolving smoothing iron, heated by means of a spirit or gas lamp internally, or its equivalent, in the manner and for the purpose substantially as described."

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98. For an *Improvement in Machines for Jointing Staves;* E. Valentine and A. Bradway, Monson, Massachusetts,

Claim.—"What we claim is, the combination of the alternate reversely curved ledges on opposite sides of the double curved channel, with the springs, and placed opposite to their concave portions, for the purpose of directing the staves alternately to the jointers, arranged along said concave portions of the ledges, with a properly curved motion for jointing both edges of the staves to a suitable form, substantially as set forth. We also claim the uniformly flexible metallic strips at the sides of the recess, just in front of the cutters, in combination with the adjusting lever, for the purpose of enabling the curvature of the stave to be varied by tightening the said metallic strips, and thus varying the curved sides of the recess, substantially as set forth."

99. For an *Improvement in Ship's Blocks;* Elbridge Webber, Gardiner, Maine.

Claim.—"What I claim is, the shell of cast or wrought metal, into which are fitted the wooden cheeks and the shieves, the whole constructed and arranged as described."

100. For an *Improvement in Presses for Treating India Rubber;* Ellsworth D. S. Goodyear, Stapleton, N. Y., Assignor to the New York Rubber Co., City of N. Y.

Claim.—"I am aware that water has been forced into the interior of hollow articles of plastic material, by mechanical means, for the purpose of forcing the material against the interior of moulds; but such mode of using a fluid I do not claim; but what I do claim is, the introduction of water, or any other liquid, into the interior of articles which require expansive force for their perfect formation to the interior surface of moulds, said liquid to be converted into steam, substantially as described."

101. For an *Improvement in Churns;* Robt. H. Harrison, Assignor to R. H. Harrison and John S. Gallaher, Jr., Washington, D. C.

Claim.—"What I claim is, 1st, The construction of a churn vessel, with hollow or solid double concave adjustable detachable side gatherers, specifically as shown. 2d, The

construction of a churn reservoir dasher, having curved or deflective radial chambers of a concavo-convex form, with direct radial wings or flanches, and the using the same, combined with the double concave gatherers. 3d, Also, the double application of warm and cold water, or ice, in combination with the dasher and the double concave gatherers, substantially as set forth. I do not, however, claim the application of hot or cold water solely in the process of butter making, as the same have been employed separately or distinctly heretofore, as is well known."

102. For an *Improvement in the Discharging Apparatus of Harvesters;* A. J. Cook, Enon, Ohio.

Claim.—"What I claim is, the device for forcing the unbound grain from the table, in combination with the arm at the end of the reel and the apron, by means whereof the grain is carried from the platform to the receiving table, and thence deposited upon the stubble, in convenient quantities for binding."

103. For an *Improvement in Belt Clasps for Machinery;* H. G. Ellsworth, Auburn, New York.

"The nature of my invention, with a view to avoid the defects enumerated, consists in splicing or uniting the ends of belts, end to end, by means of metal plates riveted or otherwise secured to the outer surface of and near the ends of the belt, which plates are made to clasp and interlock, to form the connexion and keep the inner face of the belt smooth and even, and free to bend around pulleys and drums, and be held together entirely by the union of the two part clasp, whilst the inner face of the belt which passes in contact with the pulleys or drums shall present a perfectly smooth and even surface."

Claim.—"What I claim is, the method of uniting or splicing belts end to end, by means of metal plates riveted or otherwise secured to the outer surface of, and near the ends of the belt, and clasping or interlocking, in manner substantially as described."

104. For an *Improvement in Harvesters of Grain;* Benjamin G. Fitzhugh, Frederick, Maryland.

Claim.—"I make no claim to the movable blade, in itself, as such a blade has heretofore been used. What I claim is, 1st, The movable blade in the fingers, arranged and secured in place, in the manner and for the purposes set forth. 2d, The combination of a curved reciprocating knife with a curved row of fingers and a curved platform, as described. 3d, Constructing the reel with curved beaters, substantially in the manner and for the purpose set forth. 4th, The combination of a continuously revolving sweep rake with a revolving reel, which disposes the grain upon the platform, with its stalks converging to the axis of the rake, substantially as set forth."

105. For an *Improvement in Seed Planters;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"I do not claim the form of the frame, or the method of operating the slides; but what I do claim is, the combination of the rod, lever, clevis, and pin, when the latter is movable in a longitudinal slot for raising the teeth from the ground, as set forth. Also, the attachment of the rods operating the slides to the hook, as described, so that the slides will remain at rest during the turning of the implement."

106. For an *Improvement in Feed Water Apparatus for Steam Boilers;* Benaiah Fitts, Worcester, Massachusetts.

Claim.—"What I claim is, the arrangement of the steam and water chambers, chains, pipes, and valves, constructed and operated and for the purposes set forth."

107. For an *Improvement in Making Zinc White;* Richard Jones, County of Burlington, New Jersey.

Claim.—"What I claim is, the method described, of cooling, conveying, and oxydizing the vapor of zinc by means of a jet of air introduced into a closed retort, substantially as described. I likewise claim constructing the conduit pipes so that every portion of them shall be inclined in such manner as to prevent the accumulation of matter to clog them, and to direct the current of vapor downwards on entering the condensing chambers, the conduits thus constructed and operating being arranged over the collecting or condensing chambers, substantially as described."

108. For an *Improvement in Smut Machines;* Seymour Ketchum, Lancaster, Ohio.

Claim.—"I do not claim, of itself, building the concave of staves with vertical openings between or in them, for the dust, &c., to pass through; but I do claim the concave con-

structed as described, viz: of loose staves so fitted to or connected with the heads of the concave as to be capable of circular adjustment with facility and despatch, for the purpose of varying the number and widths of the escape openings between the staves, the said staves being formed on their inner face with a longitudinal step or steps inclining outwards backwardly, in relation to the travel of the runner, whereby the width of the openings between the staves may be made large, so as to form a ready escape for the smut, dust, and other extraneous matter, without letting out the grain or wheat therethrough, and whereby the clogging of the escape openings by damp smut is avoided, essentially as set forth."

109. For *Portable Head Rests for Chairs;* C. P. Bailey, Zanesville, Ohio.

Claim.—"What I claim is, the apparatus described, consisting of a back plate with arms for supporting the band or cushion upon which the head rests, the whole being sustained by the hips which hold it in place at all times, disconnected with the back of the seat, but resting against or upon it, so as to be at once taken away without injury to the seat, and folded up in portable form, the whole being constructed and arranged substantially in the manner described."

110. For an *Improvement in Submarine Scoops;* Anson Balding, Olney, Illinois.

Claim.—"What I claim is, the combination of the scoop and sled, for the purposes described."

111. For an *Improvement in Hot Air Furnaces;* Thomas W. Chatfield, Utica, N. Y.

Claim.—"What I claim is, the radiators, constructed as described, and for the purposes described, the whole being arranged and combined substantially in the manner set forth. I am aware of the patents of Gordon Fox, patented in 1843, and of G. Walker, patented in 1844; I do not claim anything contained in either of these patents, but only those points and contrivances wherein I have improved upon both of these patents, as set forth."

112. For an *Improvement in Machinery for Operating Car Brakes;* Joseph Marks, Dunkirk, N. Y., Assignor to Wm. Whitney, Roxbury, Massachusetts; patented in England, November 23, 1852.

Claim.—"I do not claim any mode of of forcing the brakes of one or more cars against their respective wheels by any mechanism brought into action by a power generated on an axle of the engine; but what I do claim is, 1st, the adjustable spring clip or clips, in combination with the pawl lever or levers, and the draft rope thereof, and as applied and made to operate substantially in the manner specified. 2d, In combination with the cord extending from the locomotive to the brake shaft and the pulley, I claim the traveling nut, screw, stud, and pin, in the manner and for the purpose substantially as specified. 3d, The combination of the lines and the mechanism for operating the same, as described, whereby the several brake springs of a train of cars may be wound up simultaneously, or one or more of them at a time, as required, in combination with the line and the mechanism for operating the same, so that by adjustment of the spring clips the several brakes of the train may be either simultaneously, or one or more at a time, put in action to retard or arrest the motion of the cars. Finally, I claim, generally, in my improved method of operating car brakes, the combination of main springs for pressing the brakes against the wheels, mechanism for winding up the springs, so as to remove the pressure from the brakes, and to hold the springs in a state of tension, ready to apply pressure on the brakes, instantly on being released, and mechanism to release the springs, and allow them to act both the mechanism for winding up and that for releasing the springs, being so constructed and arranged that it can be operated in either the locomotive or on the separate cars, and also capable of such adjustment that the brakes of all the cars can be either simultaneously, or one or more at a time, and any required order of succession, put in action."

113. For an *Improvement in Machinery for Operating Car Brakes;* J. Marks, Boston, and J. Howarth, Salem, Assignors to Wm. Whiting, Roxbury, Massachusetts.

Claim.—"We claim so adjusting the relative lengths of the relieving branch lines of a train of two or more cars, by means of adjustable pulleys, and connecting these lines by a single main line, that all the relieving mechanism of such train may be put in operation in such a manner that the brakes of the several cars of the train may be either simultaneously or in succession thrown out of action on the wheels, or relieved of the pressure

induced by the main spring or springs, as specified. Heretofore we have constructed the main spring of a single coil, bar, or plate of metal, which being necessarily of a high temper, in order to give it sufficient strength, and prevent it from setting, it is liable to break from a variety of causes, among others, sudden changes of temperature, and, when broken, the apparatus is entirely disabled, and the lives of those depending upon its efficiency thereby endangered; to such a spring as this we make no claim; neither do we claim a spring simply composed of two or more bars, or plates of metal; but what we do claim is, the combination and arrangement of a series of independent springs, with the mechanism for applying the force produced by their tension to press the brake rubbers upon the wheels, this mechanism being put in action either for the locomotive, or from the separate cars, by the engineer, or other person having it in charge, or automatically, and with certainty and promptness to detached cars, whenever one or more of them become detached from the train, either by design or accident, in such manner that each spring will act with its whole force, independent of all the rest, so that in case one, or any number of less than the whole of the springs shall break, the mechanism will not be thereby disabled, but merely rendered less efficient, and, as even the minimum of efficiency thus left may be sufficient to prevent an accident to the car on which the apparatus is placed, and would, in any case, lessen the damage, if it did not prevent the accident, the safety of railway traveling is thereby increased. We also claim, in combination with the main spring shaft and the frame, the apparatus by which the power of the main spring is prevented from acting too suddenly, or so as to rupture or injure the brake chain, when the slack of it is taken, as stated; meaning also to claim the combination of parts or elements constituting such apparatus, the same consisting of the wheel, the rubber, the lever, spring, catch lever, slide, with its stud, cam, spring, and the tripping cam, as specified. We also claim the mechanism for disengaging the retaining pawl of the ratchet, that is to say, the tubular shaft or sleeve, and its oblique end, acting as a stop, in combination with the windlass shaft, and its oblique end, to act in connexion with the oblique end of the sleeve, as described, so that in case the shaft should be turned back by the movement of the spring, with too much force, its screw may not bind in the screw of the sleeve, and thus prevent the apparatus from working. We also claim so combining the windlass shaft with the fusees, or apparatus by which it is put in rotation, that it may be disengaged therefrom in order to relieve the car wheels from the pressure of the brakes, without rendering it necessary to do so by rewinding the springs. We also claim the combination of the key or feather, and the locking arm, or their equivalents, with the shafts, the same being for the purpose as specified. We also claim the improvement by which each windlass or pulley shaft, and its main line, is connected, viz: by a branch line or loose pulley and friction screw or contrivance, as combined together, and with the main line and windlass shaft, and made to operate in manner substantially as specified."

114. For an *Improved Device for Tonguing and Grooving Tapering Boards;* John Abersterdam and W. B. Merrill, Boston, Assignors to J. A. Woodbury, Winchester, and W. B. Merrill, Boston, Massachusetts.

Claim.—"We claim, 1st, Giving to the tonguing and grooving cutters, a motion either towards or away from the edge of the board, so as to adapt them to boards of different widths, or of a tapering shape, by means of the traveling carriage, with its adjustable cross bar, operating upon the guide and connecting bar attached to the slide which carries the cutters, substantially as described. 2d, Giving to the traveling carriage a quick or slow motion, proportionate to the length of the board to be jointed, so as to convey a similar motion to the tonguing and grooving cutters by means of the adjustable sliding bar, band, and cones, operating together, substantially as described."

115. For an *Improvement in Stereotype Pans;* Richard D. Mott, Philadelphia, Pa.

Claim.—"I do not claim the pan proper, nor its lid, as these are common; but what I claim is, the substitution and use, in stereotype pans, of a single horizontal casting plate, combined with the adjustable attachments, for holding the single-faced plaster moulds, the said attachments having chisel-like cutting edges on their ends, for cutting and trimming the said mould as they are forced, by the operator, between them and the plate; and the said casting plate having both its sides fitted with the cutting edged attachments, all constructed substantially as described."

116. For an *Improvement in Feed Motion for Sawing Lumber;* Nicholas G. Norcross, Lowell, Massachusetts.

Claim.—"What I claim is, the method of regulating the velocity of the feed rollers of

a gang of saws, viz: by a sliding wheel made to operate against the side of a wheel, and to be applied to the shaft, and pressed against the wheel, all substantially as specified."

117. For *Improvements in Machines for Forming Cultivators' Teeth;* D. B. Rogers, Pittsburgh, Pennsylvania.

Claim.—"What I claim is, the arrangement of the cutter, or knife, and swaging dies, when constructed and operated substantially as described, whereby I am enabled to swage the sheet blank into shape, and to give to the foot of the tooth, by the cutter, its shape and edge, after it has been swaged into form, and when it is held firmly between the dies."

118. For an *Improvement in Harvesters;* William H. Seymour, Brockport, N. Y.

Claim.—"What I claim is, the combination of the shaft for rotating the pinion, the shaft for turning and carrying the rake and connecting the mechanism, constructed and arranged as described, whereby the rake is turned up and down, and firmly held in either position, in a simple and convenient manner, without producing an undue strain upon any part of the driving gear. Also, the adjustment of the rake at varying heights from the platform in its elevated and depressed position, by means of the device, as described, or the equivalent thereof."

119. For an *Improvement in Pumps;* Joseph Smart, Philadelphia, Pa.

Claim.—"What I claim is, 1st, The mode of applying the outward chamber for supplying the inner chamber above the piston, and discharging the same, and the manner of connecting the valves with both chambers, as described. 2d, The upper or movable valve seat, with gate attached, with the mode of securing the same to its bed by the open washer and inside screw bearing on the top of the washer, as described."

120. For an *Improvement in the Construction of Shingle Machines;* Henry C. Smith, Cleveland, Ohio.

Claim.—"I do not claim any one of the separate devices; but what I do claim is, the special and precise arrangement, and the mode of operating the devices, as set forth."

121. For a *Machine for Tenoning, &c., Blind Slats;* T. G. Stagg, Jersey City, N. J.

Claim.—"I am aware that cutters similar to the ones described, have been previously used on rotating disks of similar purposes; I therefore do not claim the cutters, separately; but what I claim is, 1st, The employment or use of the stationary knives and the cutters, arranged upon a rotary disk, the knives and disk, with the cutters attached, being secured to a vibrating head, two heads being employed on one machine, and operating in the manner substantially as described. 2d, The employment or use of the clamp lever, and staple or pricking lever, arranged and operating as described, for the purpose of properly clamping the slat and pricking the same, or driving the staple therein."

122. For an *Improvement in Furnaces for Zinc White;* Jonathan G. Trotter, Newark, New Jersey.

Claim.—"What I claim is, the combination and use of the upper and lower discharge or passage ways from the fire-place to the furnace; that is, the upper passage way for discharging or carrying off the lighter gases from the fire-place, by the reverberatory flue and return flues, and to the chimney and the lower passage ways, for discharging the flame from the fire-place direct upon the mass of ore on the bed of the furnace, and thereby reducing or subliming it more effectually and with less consumption of fuel than ever before accomplished. Also, the combination of the alternating series of bridges or brakes in the return flues, with the reverberatory flue, doubled arched conformation of the roof of the furnace, and the upper passage way and lower passage ways from the furnace, for the purpose of working zinc ores for making white oxide of zinc, substantially as set forth."

123. For an *Improved Oil Cup for Steam Engines;* Geo. Trott, Pittsburgh, Pa.

Claim.—"What I claim is, the arrangement of a double valve, and the passages for feeding and discharging the oil, in the manner described."

124. For an *Improvement in Machines for Bending Sheet Metal;* William Webster, Morrisania, New York.

Claim.—"What I claim is, the non-axled cylinder, as arranged in relation to the rollers

and mandrel, whereby I am enabled readily to adapt it to rolling and bending sheet metal, as described."

125. For an *Improvement in Railroad Car Wheels;* R. A. Wilder, Schuylkill Haven, Pennsylvania.

Claim.—"What I claim is, the groove in the wheel near the flanch, and, in combination therewith, the convex form of the tread."

126. For an *Improvement in Track Cleaners for Railroads;* Edward H. Ashcroft, Boston, Massachusetts.

Claim.—"What I claim is, the method of cleaning snow or ice, or other like obstacles, from grooved railroad rails, by means of a picker and mould-board, or scraper, substantially as described."

127. For an *Improvement in Cooking Stoves;* Joseph Leeds, Philadelphia, Pa.

"The nature of my invention consists in forming the fire box, or chamber, of a series of vertical pipes or tubes, through which air passes from a receiving air chamber underneath, which is entirely separated from the ash box, and becomes highly heated, and passes up underneath the top plate, and around the oven, for cooking or baking purposes, and in so arranging the oven, into which hot air may be introduced, if required, as that none of its sides or plates shall be in contact with the heated products of combustion, but be surrounded by hot air, by which means the most perfect regulation of heat may be kept therein."

Claim.—"What I claim is, 1st, A fire box, formed or composed of a series of vertical tubes, through which air is introduced to be heated, in combination with the air space under the top plate, and around the oven, substantially as described. Also, so arranging the oven as it shall not be in contact with any of the plates which are directly in contact with the heated products of combustion, but be heated by hot air, substantially as described."

128. For an *Improved Hand Printing Press;* Henry Underhill, Canandaigua, N. Y.

Claim.—"What I claim is, the method of operating the platen by hand, intermittently, in connexion with a reciprocating double frisket carriage, whose movement is derived from a continuous rotary motion, whether produced by hand or power, so that as the carriage brings the frisket of each end alternately under the platen, the latter may be made to descend at the will of the attendant, and independently of the movement of the carriage, so its depression may be omitted if a blank sheet is not placed over the form, substantially as described."

129. For an *Improvement in Sacket's Braiding Machine;* Ephraim Sizer, Titus Sizer, Emerson Sizer, and Amos Halladay, Westfield, Massachusetts.

Claim.—"What we claim is, the construction of the racers with the guides, substantially as described. Also, the combination of the spring guides, with the flanches, on the carriers, substantially as set forth. We further claim guiding the racers by means of spring and tail-guides, operating on the interior or exterior of the shell or circle, substantially as set forth."

130. For an *Improved Method of Operating the Doctors of Calico-Printing Cylinders;* James Bavendale, Fall River, Assignor to himself and James Ferguson, Taunton, Massachusetts.

Claim.—"I claim a compound traverse mechanism, constructed of eccentric gears and a pinion gear, and a supporting frame, substantially as described, as applied for obtaining a compound traverse, or constantly variable reciprocating movement of the doctor of a calico-printing roller."

Additional Improvement.

1. For an *Apparatus for Opening and Closing Gates;* Samuel G. Dugdale, Richmond, Indiana; dated March 7, 1854; original letters patent dated Oct. 11, 1853; re-issued January 31, 1854.

Claim.—"What I claim is, the application of a pendulous lever provided with a notch, or its equivalent, in the manner and for the purpose as set forth."

Re-Issues for March, 1854.

1. For an *Improved Shingle Machine;* Enoch R. Morrison, Troy, Pennsylvania; dated November 22, 1853; re-issued March 7, 1854.

Claim.—"What I claim is, riving and carrying forward of the riven shingle, by the intermittently reciprocating movement of the riving knife stock or frame, so as to be operated upon successively by the shaving and edging knives, said motion being imparted by the movement of the riving knife stock through the intervention of the spring hooks, stops, or dogs, or their equivalents, substantially as described."

2. For *Improvements in Substrata for Pavements;* Horace P. Russ, N. York; original letters patent dated March 14, 1848; re-issued March 28, 1854.

Claim.—"I do not claim any of the materials or parts described, as used herein, all being well known; but I do claim, 1st, Leaving seams, or other openings, in the concrete foundation, substantially in the manner described, that the direct escape of the water, gas, &c., may indicate the point or points at which repairs in the pipes are required. 2d, The constructing of panels or sections to the concrete foundation, to give access to pipes and conduits below, by the application and combination therewith of frames formed of any suitable material, with the thinner edge upwards, to allow the concrete mass to be lifted out when necessary, substantially as described, when this is combined with a paved roadway of any kind laid thereon, as described."

Designs for March, 1854.

1. For a *Panel Ornament for Stoves, &c.;* Isaac De Zouche, Assignor to Louis Potter, Troy, New York; dated March 14, 1854.

"The design of my panel ornament consists of the flowers and stem, leaves, shells, and centre pieces, combined and arranged."

Claim.—"What I claim is, the ornamental configuration and arrangement of the parts."

2. For *Stoves;* John F. Allen and Joseph Stewart, Assignors to North, Chase and North, Philadelphia, Pennsylvania; dated March 21, 1854.

Claim.—"We claim the design and configuration of the ornaments and mouldings described."

3. For *Cooking Stoves;* Samuel D. Vose, Albany, New York; dated March 28, 1854.

Claim.—"I do not claim any separate figure or ornament, or any of these parts; what I claim is, the arrangement of the several figures and mouldings, combined together."

4. For *Coal Stoves;* Samuel D. Vose, Albany, New York; dated March 28, 1854.

Claim.—"I do not claim any separate ornament upon either of these plates or parts; what I claim is, the combination and arrangement of the several figures and mouldings."

LAW REPORTS OF PATENT CASES.

Telegraph Case in the Supreme Court of the United States.

HENRY O'RIELLY, EUGENE L. WHITMAN, AND W. F. B. HASTINGS, *Appellants, vs.* SAMUEL F. B. MORSE, ALFRED VAIL, AND FRANCIS O. J. SMITH, *Appellees.*

1. Morse's invention of the telegraph was prior to that of Steinheil, Wheatstone, or Davy.—(Unanimous decision of Court.)
2. Morse's invention is different from, and superior to, those of Steinheil, Wheatstone, and Davy.
3. The fact that Morse sought and obtained from men of science, information and advice, neither impairs his rights as an inventor nor detracts from his merits. (Unanimous.)
4. Morse's patent of 1840, is not void by reason of not corresponding in date with the French patent. (Unanimous.)
5. In the opinion of Justices Taney, M'Lean, Catron, and Daniels, the eighth claim of Professor Morse's patent of 1840, is broader than the law warrants; but this does not invalidate the whole patent, because there has been no unreasonable delay in entering a disclaimer.

   Justices Nelson, Wayne, and Grier, held the eighth claim to be valid, and dissented from the four other Justices on this point.*
6. Morse's second patent, or local circuit patent, being for an improvement upon a machine already patented by him, is not, on that account, void. (Unanimous.)
7. A patentee improving upon a former invention patented by himself, may either annex the improvement to his former specification, or take out a new and distinct patent for such improvement. (Unanimous.)
8. The local circuit patent is for a distinct invention not described in the first patent, and is therefore valid. (Unanimous.)
9. The defendants have infringed both of Morse's patents, and the decree of the Court below awarding a perpetual injunction, must be affirmed. (Unanimous.)
10. In the opinion of Justices Taney, M'Lean, Catron, and Daniels, the complainants are not entitled to costs.†

    Justices Grier, Nelson, and Wayne, dissented on the last point, and held that the complainants should be entitled to costs.

This case was brought up by an appeal from a decision of the Circuit Court of the United States for the District of Kentucky.

The appeal was argued in 1853 by General GILLETT and Hon. S. P. CHASE, for the Appellants; and GEORGE HARDING, ST. GEORGE T. CAMPBELL, and GEORGE GIFFORD, for the Appellees; after which, the Court held the case under advisement, and entered the following decision in February, 1854.

* The Supreme Court is composed of nine Justices. At the time of the hearing this cause, there were but seven Justices present; there being one vacancy in the Court, caused by the death of Justice M'Kinley, and Justice Curtis declining to sit, on account of his former professional relations to the Morse patents. The opinion of the four Justices on this point cannot, therefore, be regarded as the final decision of the Court on this important question of patent law.

† The costs here refused, are only the taxable costs of Court, and must be distinguished from damages for the infringement, the right to recover which, still belongs to the complainants.

Mr. CHIEF JUSTICE TANEY delivered the opinion of the Court, as follows:—

In proceeding to pronounce judgment in this case, the Court is sensible, not only of its importance, but of the difficulties in some of the questions which it presents for decision. The case was argued at the last Term, and continued over by the Court for the purpose of giving it a more deliberate examination. And since the continuance, we have received from the counsel on both sides printed arguments, in which all of the questions raised on the trial have been fully and elaborately discussed.

The appellants take three grounds of defence: In the first place, they deny that Professor Morse was the first and original inventor of the Electro-Magnetic Telegraphs, described in his two reissued patents of 1848. Secondly, they insist that if he was the original inventor, the patents under which he claims have not been issued conformably to the acts of Congress, and do not confer on him the right to the exclusive use. And thirdly, if these two propositions are decided against them, they insist that the Telegraph of O'Rielly is substantially different from that of Professor Morse, and the use of it, therefore, no infringement of his rights.

In determining these questions, we shall, in the first instance, confine our attention to the patent which Professor Morse obtained in 1840, and which was reissued in 1848. The main dispute between the parties is upon the validity of this patent; and the decision upon it will dispose of the chief points in controversy in the other.

In relation to the first point, (the originality of the invention,) many witnesses have been examined on both sides.

It is obvious that, for some years before Professor Morse made his invention, scientific men in different parts of Europe were earnestly engaged in the same pursuit. Electro-Magnetism itself was a recent discovery, and opened to them a new and unexplored field for their labors, and minds of a high order were engaged in developing its power, and the purposes to which it might be applied.

Professor Henry, of the Smithsonian Institute, states in his testimony, that prior to the winter of 1819-20, an Electro-Magnetic Telegraph—that is to say, a Telegraph operating by the combined influence of electricity and magnetism—was not possible; that the scientific principles on which it is founded were until then unknown; and that the first fact of Electro-Magnetism was discovered by Oersted, of Copenhagen, in that winter, and was widely published, and the account everywhere received with interest.

He also gives an account of the various discoveries subsequently made from time to time, by different persons in different places, developing its properties and powers; and among them his own. He commenced his researches in 1828, and pursued them with ardor and success from that time until the Telegraph of Professor Morse was established and in actual operation. And it is due to him to say that no one has contributed more to enlarge the knowledge of Electro-Magnetism, and to lay the foundations of the great invention of which we are speaking, than the Professor himself.

It is unnecessary, however, to give in detail the discoveries enumerated by him—either his own, or those of others. But it appears from his testimony, that very soon after the discovery made by Oersted, it was believed by men of science that this newly-discovered power might be used to communicate intelligence to distant places. And before the year 1823, Ampère, of Paris, one of the most successful cultivators of physical science, proposed to the French Academy a plan for that purpose. But his project was never reduced to practice. And the discovery made by Barlow, of the Royal Military Academy at Woolwich, England, in 1825, that the galvanic current greatly diminished in power as the distance increased, put at rest for a time all attempts to construct an Electro-Magnetic Telegraph. Subsequent discoveries, however, revived the hope; and in the year 1832, when Professor Morse appears to have devoted himself to the subject, the conviction was general among men of science everywhere, that the object could, and, sooner or later, would be accomplished.

The great difficulty in their way was the fact that the galvanic current, however strong in the beginning, became gradually weaker as it advanced on the wire; and was not strong enough to produce mechanical effect after a certain distance had been traversed. But encouraged by the discoveries which were made from time to time, and strong in the belief that an Electro-Magnetic Telegraph was practicable, many eminent and scientific men in Europe, as well as in this country, became deeply engaged in endeavoring to surmount what appeared to be the chief obstacle to its success. And in this state of things, it ought not to be a matter of surprise, that four different Magnetic Telegraphs, purporting to have overcome the difficulty, should be invented, and made public so nearly at the same time that each has claimed a priority; and that a close and careful scrutiny of the facts in each case is necessary to decide between them. The inventions were so nearly simultaneous, that neither inventor can be justly accused of having derived any aid from the discoveries of the other.

One of these inventors, Doctor Steinheil, of Munich, in Germany, communicated his discovery to the Academy of Science in Paris, on the 19th of July, 1838, and states in his communication that it had been in operation more than a year.

Another of the European inventors, Professor Wheatstone, of London, in the month of April, 1837, explained to Professors Henry and Bache, who were then in London, his plan of an Electro-Magnetic Telegraph, and exhibited to them his method of bringing into action a second galvanic circuit in order to provide a remedy for the diminution of force in a long circuit; but it appears by the testimony of Professor Gale, that the patent to Wheatstone & Cooke was not sealed until January 21, 1840, and their specification was not filed until the 21st of July, in the same year; and there is no evidence that any description of it was published before 1839.

The remaining European patent is that of Edward Davy. His patent, it appears, was sealed on the 4th of July, 1838, but his specification was not filed until January 4, 1839; and when these two English patents are brought into competition with that of Morse, they must take date from

the time of filing their respective specifications. For it must be borne in mind that, as the law then stood in England, the inventor was allowed six months to file the description of his invention after his patent was sealed, while, in this country, the filing of the specification is simultaneous with the application for patents.

The defendants contend that all, or at least some one of these European Telegraphs, were invented and made public before the discovery claimed by Morse; and that the process and method by which he conveys intelligence to a distance is substantially the same, with the exception only of its capacity for impressing upon paper the marks or signs described in the alphabet he invented.

Waiving, for the present, any remarks upon the identity or similitude of these inventions, the Court is of opinion that the first branch of the objection cannot be maintained, and that Morse was the first and original inventor of the Telegraph described in his specification, and preceded the three European inventions relied on by the defendants.

The evidence is full and clear that when he was returning from a visit to Europe, in 1832, he was deeply engaged upon this subject during the voyage; and that the process and means were so far developed and arranged in his own mind, that he was confident of ultimate success. It is in proof that he pursued these investigations with unremitting ardor and industry, interrupted occasionally by pecuniary embarrassments; and we think that it is established by the testimony of Professor Gale and others, that early in the spring of 1837, Morse had invented his plan for combining two or more Electric or Galvanic Circuits, with independent Batteries, for the purpose of overcoming the diminished force of Electro-Magnetism in long circuits, although it was not disclosed to the witness until afterwards; and that there is reasonable ground for believing that he had so far completed his invention, that the whole process, combination, powers, and machinery, were arranged in his mind, and that the delay in bringing it out arose from his want of means; for it required the highest order of mechanical skill to execute and adjust the nice and delicate work necessary to put the Telegraph into operation, and the slightest error or defect would have been fatal to its success. He had not the means at that time to procure the services of workmen of that character; and without their aid no model could be prepared which would do justice to his invention; and it moreover required a large sum of money to procure proper materials for the work. He, however, filed his caveat on the 6th of October, 1837, and on the 7th of April, 1838, applied for his patent, accompanying his application with a specification of his invention, and describing the process and means used to produce the effect. It is true that O'Rielly in his answer alleges that the plan by which he now combines two or more galvanic or electric currents, with independent batteries, was not contained in that specification, but discovered and interpolated afterwards; but there is no evidence whatever to support this charge. And we are satisfied from the testimony, that the plan, as it now appears in his specification, had then been invented, and was actually intended to be described.

With this evidence before us, we think it is evident that the invention of Morse was prior to that of Steinheil, Wheatstone, or Davy. The dis-

covery of Steinheil, taking the time which he himself gave to the French Academy of Science, cannot be understood as carrying it back beyond the months of May or June, 1837; and that of Wheatstone, as exhibited to Professors Henry and Bache, goes back only to April in that year. And there is nothing in the evidence to carry back the invention of Davy beyond the 4th of January, 1839, when his specification was filed, except a publication said to have been made in the *London Mechanics' Magazine*, January 20, 1838; and the invention of Morse is justly entitled to take date from early in the spring of 1837. And in the description of Davy's invention, as given in the publication of January 20, 1838, there is nothing specified which Morse could have borrowed; and we have no evidence to show that his invention ever was or could be carried into successful operation.

In relation to Wheatstone, there would seem to be some discrepancy in the testimony. According to Professor Gale's testimony, as before mentioned, the specification of Wheatstone and Cooke was not filed until July 21, 1840, and his information is derived from the *London Journal of Arts and Sciences*. But it appears by the testimony of Edward F. Barnes, that this Telegraph was in actual operation in 1839. And in the case of the Electric Telegraph Company *vs.* Brett & Little, 10 Common Pleas Reports, by Scott, his specification is said to have been filed Dec. 12, 1837. But if the last mentioned date is taken as the true one, it would not make his invention prior to that of Morse. And even if it would, yet this case must be decided by the testimony in the record, and we cannot go out of it, and take into consideration a fact stated in a book of reports. Moreover, we have noticed this case merely because it has been pressed into the argument. The appellants do not mention it in their answer, nor put their defence on it. And if the evidence of its priority was conclusive, it would not avail them in this suit. For they cannot be allowed to surprise the patentee by evidence of a prior invention of which they gave him no notice.

But if the priority of Morse's invention was more doubtful, and it was conceded that in fact some one of the European inventors had preceded him a few months or a few weeks, it would not invalidate his patent. The act of Congress provides that when the patentee believes himself to be the first inventor, a previous discovery in a foreign country shall not render his patent void, unless such discovery or some substantial part of it had been before patented or described in a printed publication.

Now we suppose no one will doubt that Morse believed himself to be the original inventor when he applied for his patent in April, 1838. Steinheil's discovery does not appear to have been ever patented, nor to have been described in any printed publication until July of that year. And neither of the English inventions are shown by the testimony to have been patented until after Morse's application for a patent, nor to have been so described in any previous publication as to embrace any substantial part of his invention. And if his application for a patent was made under such circumstances, the patent is good, even if, in point of fact, he was not the first inventor.

In this view of the subject, it is unnecessary to compare the Telegraph of Morse with these European inventions, to ascertain whether they are

substantially the same or not. If they were the same in every particular, it would not impair his rights. But it is impossible to examine them, and look at the process and the machinery and results of each, so far as the facts are before us, without perceiving at once the substantial and essential difference between them, and the decided superiority of the one invented by Professor Morse.

Neither can the inquiries he made, nor the information or advice he received from men of science, in the course of his researches, impair his right to the character of an inventor. No invention can possibly be made, consisting of a combination of different elements of power, without a thorough knowledge of the properties of each of them, and the mode in which they operate on each other. And it can make no difference in this respect whether he derives his information from books, or from conversation with men skilled in the science. If it were otherwise, no patent in which a combination of different elements is used, could ever be obtained. For no man ever made such an invention without having first obtained this information, unless it was discovered by some fortunate accident. And it is evident that such an invention as the Electro-Magnetic Telegraph could never have been brought into action without it. For a very high degree of scientific knowledge, and the nicest skill in the mechanic arts, are combined in it, and were both necessary to bring it into successful operation. And the fact that Morse sought and obtained the necessary information and counsel from the best sources, and acted upon it, neither impairs his rights as an inventor, nor detracts from his merits.

Regarding Professor Morse as the first and original inventor of the Telegraph, we come to the objections which have been made to the validity of his patent.

We do not think it necessary to dwell upon the objections taken to the proceedings upon which the first patent was issued, or to the additional specifications in the reissued patent of 1848. In relation to the first, if there was any alteration, at the suggestion of the Commissioner, it appears to have been in a matter of form rather than of substance; and as regards the second, there is nothing in the proof, or on the face of the reissued patent, to show that the invention therein described is not the same with the one intended to be secured by the original patent. It was reissued by the proper lawful authority, and it was the duty of the Commissioner of Patents to see that it did not cover more than the original invention. It must be presumed, therefore, that it does not, until the contrary appears. Variations from the description given in the former specification do not necessarily imply that it is for a different discovery. The right to surrender the old patent, and receive another in its place, was given for the purpose of enabling the patentee to give a more perfect description of his invention, when any mistake or oversight was committed in his first. It necessarily, therefore, varies from it. And we see nothing in the reissued patent that may not, without proof to the contrary, be regarded as a more careful description than the former one, explaining more fully the nice and delicate manner in which the different elements of power are arranged and combined together and act upon one another, in order to produce the effect described in the specification.

Nor is it void because it does not bear the same date with his French patent. It is not necessary to inquire whether the application of Professor Morse to the Patent Office, in 1838, before he went to France, does or does not exempt his patent from the operation of the act of Congress upon this subject. For if it should be decided that it does not exempt it, the only effect of that decision would be to limit the monopoly to fourteen years from the date of the foreign patent. And in either case the patent was in full force at the time the injunction was granted by the Circuit Court, and when the present appeal stood regularly for hearing in this Court.

And this brings us to the exceptions taken to the specification and claims of the patentee in the reissued patent of 1848.

We perceive no well-founded objection to the description which is given of the whole invention and its separate parts, nor to his right to a patent for the first seven inventions set forth in the specification of his claims. The difficulty arises on the eighth.

It is in the following words:

"Eighth. I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specification and claims; the essence of my invention being the use of the motive power of the electric or galvanic current, which I call Electro-Magnetism, however developed, for marking or printing intelligible characters, signs, or letters, at any distances, being a new application of that power of which I claim to be the first inventor or discoverer."

It is impossible to misunderstand the extent of this claim. He claims the exclusive right to every improvement where the motive power is the electric or galvanic current, and the result is the marking or printing intelligible characters, signs, or letters, at a distance.

If this claim can be maintained, it matters not by what process or machinery the result is accomplished. For aught that we now know, some future inventor in the onward march of science may discover a mode of writing or printing at a distance, by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. His invention may be less complicated—less liable to get out of order—less expensive in construction and in its operation. But yet, if it is covered by this patent, the inventor could not use it, nor the public have the benefit of it, without the permission of this patentee.

Nor is this all. While he shuts the door against inventions of other persons, the patentee would be able to avail himself of new discoveries in the properties and powers of Electro-Magnetism which scientific men might bring to light. For he says he does not confine his claims to the machinery or parts of machinery which he specifies: but claims for himself a monopoly in its use, however developed, for the purpose of printing at a distance. New discoveries in physical science may enable him to combine it with new agents and new elements, and by that means attain the object in a manner superior to the present process, and altogether different from it. And if he can secure the exclusive use, by his present patent, he may vary it with every new discovery and developement of the science, and need place no description of the new manner,

process, or machinery, upon the records of the Patent Office. And when his patent expires, the public must apply to him to learn what it is. In fine, he claims an exclusive right to use a manner and process which he has not described, and indeed had not invented, and therefore could not describe when he obtained his patent. The Court is of opinion that the claim is too broad, and not warranted by law.

No one, we suppose, will maintain that Fulton could have taken out a patent for his invention of propelling vessels by steam, describing the process and machinery he used, and claimed under it the exclusive right to use the motive power of steam, however developed, for the purpose of propelling vessels. It can hardly be supposed that under such a patent he could have prevented the use of the improved machinery which science has since introduced; although the motive power is steam, and the result is the propulsion of vessels. Neither could the man who first discovered that steam might, by a proper arrangement of machinery, be used as a motive power to grind corn or spin cotton, claim the right to the exclusive use of steam, as a motive power, for the purpose of producing such effects.

Again, the use of steam as a motive power in printing presses is comparatively a modern discovery. Was the first inventor of a machine or process of this kind entitled to a patent, giving him the exclusive right to use steam as a motive power, however developed, for the purpose of marking or printing intelligible characters? Could he have prevented the use of any other press subsequently invented, where steam was used? Yet so far as patentable rights are concerned, both improvements must stand on the same principles. Both use a known motive power to print intelligible marks or letters; and it can make no difference, in their legal rights under the patent laws, whether the printing is done near at hand or at a distance. Both depend for success not merely upon the motive power, but upon the machinery with which it is combined. And it has never, we believe, been supposed by any one, that the first inventor of a steam printing-press was entitled to the exclusive use of steam, as a motive power, however developed, for marking or printing intelligible characters.

Indeed, the acts of the patentee himself are inconsistent with the claim made in his behalf. For in 1846 he took out a patent for his new improvement of local circuits, by means of which intelligence could be printed at intermediate places along the main line of the Telegraph; and he obtained a reissued patent for this invention in 1848. Yet in this new invention the electric or galvanic current was the motive power, and writing at a distance the effect. The power was undoubtedly developed by new machinery and new combinations. But if his 8th claim could be sustained, this improvement would be embraced by his first patent. And if it was so embraced, his patent for the local circuits would be illegal and void. For he could not take out a subsequent patent for a portion of his first invention, and thereby extend his monopoly beyond the period limited by law.

Many cases have been referred to in the argument, which have been decided upon this subject, in the English and American courts. We shall speak of those only which seem to be considered as leading ones.

And those most relied on, and pressed upon the Court, in behalf of the patentee, are the cases which arose in England upon Neilson's patent for the introduction of heated air between the blowing apparatus and the furnace in the manufacture of iron.

The leading case upon this patent is that of Neilson and others *vs.* Harford and others, in the English Court of Exchequer. It was elaborately argued, and appears to have been carefully considered by the Court. The case was this:—

Neilson in his specification described his invention as one for the improved application of air to produce heat in fires, forges, and furnaces, where a blowing apparatus is required. And it was to be applied as follows:—The blast or current of air produced by the blowing apparatus was to be passed from it into an air-vessel or receptacle made sufficiently strong to endure the blast; and through or from that vessel or receptacle by means of a tube, pipe, or aperture, into the fire: the receptacle to be kept artificially heated to a considerable temperature by heat externally applied. He then described in rather general terms the manner in which the receptacle might be constructed and heated, and the air conducted through it to the fire: stating that the form of the receptacle was not material, nor the manner of applying heat to it. In the action above mentioned for the infringement of this patent, the defendant, among other defences, insisted—that the machinery for heating the air and throwing it hot into the furnace was not sufficiently described in the specification, and the patent void on that account—and also, that a patent for throwing hot air into the furnace, instead of cold, and thereby increasing the intensity of the heat, was a patent for a principle, and that a principle was not patentable.

Upon the first of these defences the jury found that a man of ordinary skill and knowledge of the subject, looking at the specification alone, could construct such an apparatus as would be productive of a beneficial result sufficient to make it worth while to adapt it to the machinery in all cases of forges, cupolas, and furnaces, where the blast is used.

And upon the second ground of defence, Baron Parke, who delivered the opinion of the Court, said:—

"It is very difficult to distinguish it from the specification of a patent for a principle, and this at first created in the minds of the Court much difficulty; but after full consideration, we think that the plaintiff does not merely claim a principle, but a machine embodying a principle, and a very valuable one. We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it by a mechanical apparatus to furnaces; and his invention then consists in this: by interposing a receptacle for heated air between the blowing apparatus and the furnace. In this receptacle he directs the air to be heated by the application of heat externally to the receptacle, and thus he accomplishes the object of applying the blast, which was before cold air, in a heated state to the furnace."

We see nothing in this opinion differing in any degree from the familiar principles of law applicable to patent cases. Neilson claimed no particular mode of constructing the receptacle, or of heating it. He pointed out the manner in which it might be done; but admitted that it

might also be done in a variety of ways; and at a higher or lower temperature; and that all of them would produce the effect in a greater or less degree, provided the air was heated by passing through a heated receptacle. And hence it seems that the Court at first doubted whether it was a patent for anything more than the discovery that hot air would promote the ignition of fuel better than cold. And if this had been the construction, the Court, it appears, would have held his patent to be void; because the discovery of a principle in natural philosophy or physical science is not patentable.

But after much consideration, it was finally decided that this principle must be regarded as well known, and that the plaintiff had invented a mechanical mode of applying it to furnaces; and that his invention consisted in interposing a heated receptacle between the blower and the furnace, and by this means heating the air after it left the blower, and before it was thrown into the fire. Whoever, therefore, used this method of throwing hot air into the furnace, used the process he had invented, and thereby infringed his patent, although the form of the receptacle or the mechanical arrangements for heating it might be different from those described by the patentee. For whatever form was adopted for the receptacle, or whatever mechanical arrangements were made for heating it, the effect would be produced in a greater or less degree, if the heated receptacle was placed between the blower and the furnace, and the current of air passed through it.

Undoubtedly the principle that hot air will promote the ignition of fuel better than cold, was embodied in this machine. But the patent was not supported, because this principle was embodied in it. He would have been equally entitled to a patent, if he had invented an improvement in the mechanical arrangements of the blowing apparatus, or in the furnace, while a cold current of air was still used. But this patent was supported, because he had invented a mechanical apparatus, by which a current of hot air instead of cold could be thrown in. And this new method was protected by his patent. The interposition of a heated receptacle in any form was the novelty he invented.

We do not perceive how the claim, in the case before us, can derive any countenance from this decision. If the Court of Exchequer had said that Neilson's patent was for the discovery that hot air would promote ignition better than cold, and that he had an exclusive right to use it for that purpose, there might, perhaps, have been some reason to rely upon it. But the Court emphatically denied his right to such a patent; and his claim, as the patent was construed and supported by the Court, is altogether unlike that of the patentee before us.

For Neilson discovered that by interposing a heated receptacle between the blower and the furnace, and conducting the current of air through it, the heat in the furnace was increased. And this effect was always produced, whatever might be the form of the receptacle, or the mechanical contrivances for heating it, or for passing the current of air through it, and into the furnace.

But Professor Morse has not discovered that the electric or galvanic current will always print at a distance, no matter what may be the form of the machinery or mechanical contrivances through which it passes.

You may use Electro-Magnetism as a motive power, and yet not produce the described effect—that is, print at a distance intelligible marks or signs. To produce that effect it must be combined with and passed through and operate upon certain complicated and delicate machinery adjusted and arranged upon philosophical principles, and prepared by the highest mechanical skill. And it is the high praise of Professor Morse, that he has been able by a new combination of known powers, of which Electro-Magnetism is one, to discover a method by which intelligible marks or signs may be printed at a distance. And for the method or process thus discovered he is entitled to a patent. But he has not discovered that the Electro-Magnetic current, used as a motive power, in any other method, and with any other combination, will do as well.

We have commented on the case in the Court of Exchequer more fully, because it has attracted much attention in the courts of this country as well as in the English courts, and has been differently understood. And perhaps a mistaken construction of that decision has led to the broad claim in the patent now under consideration.

We do not deem it necessary to remark upon the other English decisions in relation to Neilson's patent, nor upon the other cases referred to, which stand upon similar principles. The observations we have made on the case in the Court of Exchequer will equally apply to all of them.

We proceed to the American decisions; and the principles herein stated were fully recognised by this Court in the case of Leroy *et al. vs.* Tatham and others, decided at the last Term, 14 How., 156.

It appeared in that case that the patentee had discovered that lead, recently set, would, under heat and pressure in a close vessel, reunite perfectly after a separation of its parts, so as to make wrought instead of cast pipe. And the Court held that he was not entitled to a patent for this newly-discovered principle or quality in lead; and that such a discovery was not patentable; but that he was entitled to a patent for the new process or method in the art of making lead pipe which this discovery enabled him to invent and employ; and was bound to describe such process or method fully in his specification.

Many cases have also been referred to which were decided in the Circuit Courts. It will be found, we think, upon careful examination, that all of them, previous to the decision on Neilson's patent, maintained the principles on which this decision is made. Since that case was reported, it is admitted that decisions have been made which would seem to extend patentable rights beyond the limits here marked out. As we have already said, we see nothing in that opinion which would sanction the introduction of any new principle in the law of patents; but if it were otherwise, it would not justify this Court in departing from what we consider as established principles in the American courts. And to show what was heretofore the doctrine upon this subject, we refer to the annexed cases. We do not stop to comment on them, because such an examination would extend this opinion beyond all reasonable bounds. 1 Stor. Rep. 270, 285; Wyeth *vs.* Stone, 3 Sumn. 540; Blanchard *vs.* Sprague. The first-mentioned case is directly in point.

Indeed, independently of judicial authority, we do not think that the language used in the act of Congress can justly be expounded otherwise.

The 5th section of the act of 1836 declares that a patent shall convey to the inventor, for a term not exceeding fourteen years, the exclusive right of making, using, and vending to others to be used, his invention or discovery, referring to the specification for the particulars thereof.

The 6th section directs who shall be entitled to a patent, and the terms and conditions on which it may be obtained. It provides that any person shall be entitled to a patent who has discovered or invented a new and useful art, machine, manufacture, or composition of matter, or a new and useful improvement on any previous discovery in either of them. But before he receives a patent, he shall deliver a written description of his invention or discovery, "*and of the manner and process of making, constructing, using, and compounding the same,*" in such exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same.

This Court has decided that the specification required by this law is a part of the patent, and that the patent issues for the invention described in the specification.

Now whether the Telegraph is regarded as an art or machine, the manner and process of making or using it must be set forth in exact terms. The act of Congress makes no difference in this respect between an art and a machine. An improvement in the art of making bar iron or spinning cotton must be so described, and so must the art of printing by the motive power of steam. And in all of these cases, it has always been held that the patent embraces nothing more than the improvement described and claimed as new, and that any one who afterwards discovered a method of accomplishing the same object, substantially and essentially differing from the one described, had a right to use it. Can there be any good reason why the art of printing at a distance, by means of the motive power of the electric or galvanic current, should stand on different principles? Is there any reason why the inventor's patent should cover broader ground? It would be difficult to discover anything in the act of Congress which would justify this distinction. The specification of this patentee describes his invention or discovery, and the manner and process of constructing and using it, and his patent, like inventions in the other arts above mentioned, covers nothing more.

The provisions of the acts of Congress in relation to patents may be summed up in a few words.

Whoever discovers that a certain useful result will be produced in any art, machine, manufacture or composition of matter, by the use of certain means, is entitled to a patent for it; provided he specifies the means he uses in a manner so full and exact, that any one skilled in the science to which it appertains can, by using the means he specifies, without any addition to, or subtraction from, them, produce precisely the result he describes. And if this cannot be done by the means he describes, the patent is void. And if it can be done, then the patent confers on him the exclusive right to use the means he specifies to produce the result or effect he describes, and nothing more. And it makes no difference in this respect whether the effect is produced by chemical agency or combination; or by the application of discoveries or principles in natural

philosophy, known or unknown before his invention; or by machinery acting altogether upon mechanical principles. In either case, he must describe the manner and process as above mentioned, and the end it accomplishes. And any one may lawfully accomplish the same end without infringing the patent, if he uses means substantially different from those described.

Indeed, if the 8th claim of the patentee can be maintained, there was no necessity for any specification, further than to say that he had discovered that by using the motive power of Electro-Magnetism, he could print intelligible characters at any distance. We presume it will be admitted on all hands that no patent could have issued on such a specification. Yet this claim can derive no aid from the specification filed. It is outside of it, and the patentee claims beyond it. And if it stands, it must stand simply on the gronnd that the broad terms above mentioned were a sufficient description, and entitled him to a patent in terms equally broad. In our judgment, the act of Congress cannot be so construed.

The patent then being illegal and void, so far as respects the 8th claim, the question arises whether the whole patent is void, unless this portion of it is disclaimed in a reasonable time after the patent issued.

It has been urged on the part of the complainants that there is no necessity for a disclaimer in a case of this kind. That it is required in those cases only in which the party commits an error in fact, in claiming something which was known before, and of which he was not the first discoverer; that in this case he was the first to discover that the motive power of Electro-Magnetism might be used to write at a distance; and that his error, if any, was a mistake in law in supposing his invention, as described in his specification, authorized this broad claim of exclusive privilege; and that the claim, therefore, may be regarded as a nullity, and allowed to stand in the patent without a disclaimer, and without affecting the validity of the patent.

This distinction can hardly be maintained. The act of Congress above recited requires that the invention shall be so described, that a person skilled in the science to which it appertains, or with which it is most nearly connected, shall be able to construct the improvement from the description given by the inventor.

Now in this case there is no description but one of a process by which signs or letters may be printed at a distance. And yet he claims the exclusive right to any other mode and any other process, although not described by him, by which the end can be accomplished, if Electro-Magnetism is used as the motive power. That is to say, he claims a patent for an effect produced by the use of Electro-Magnetism distinct from the process or machinery necessary to produce it. The words of the act of Congress above quoted show that no patent can lawfully issue upon such a claim. For he claims what he has not described in the manner required by law. And a patent for such a claim is as strongly forbidden by the act of Congress as if some other person had invented it before him.

Why, therefore, should he be required and permitted to disclaim in the one case and not in the other? The evil is the same if he claims

more than he has invented, although no other person has invented it before him. He prevents others from attempting to improve upon the manner and process which he has described in his specification, and may deter the public from using it, even if discovered. He can lawfully claim only what he has invented and described, and if he claims more his patent is void. And the judgment in this case must be against the patentee, unless he is within the act of Congress which gives the right to disclaim.

The law which requires and permits him to disclaim is not penal, but remedial. It is intended for the protection of the patentee as well as the public, and ought not, therefore, to receive a construction that would restrict its operation within narrower limits than its words fairly import. It provides, "that when any patentee shall have in his specification claimed to be the first and original inventor or discoverer of any material or substantial part of the thing patented, of which he was not the first and original inventor, and shall have no legal or just claim to the same,"—he must disclaim in order to protect so much of the claim as is legally patented.

Whether, therefore, the patent is illegal in part, because he claims more than he has sufficiently described, or more than he invented, he must in either case disclaim, in order to save the portion to which he is entitled; and he is allowed to do so when the error was committed by mistake.

A different construction would be unjust to the public, as well as to the patentee, and defeat the manifest object of the law, and produce the very evil against which it intended to guard.

It appears that no disclaimer has yet been entered at the Patent Office. But the delay in entering it is not unreasonable. For the objectionable claim was sanctioned by the head of the office; it has been held to be valid by a Circuit Court, and differences of opinion in relation to it are found to exist among the justices of this Court. Under such circumstances, the patentee had a right to insist upon it, and not disclaim it until the highest court to which it could be carried had pronounced its judgment. The omission to disclaim, therefore, does not render the patent altogether void, and he is entitled to proceed in this suit for an infringement of that part of his invention which is legally claimed and described. But as no disclaimer was entered in the Patent Office before this suit was instituted, he cannot, under the act of Congress, be allowed costs against the wrong-doer, although the infringement should be proved. And we think it is proved by the testimony. But as the question of infringement embraces both of the reissued patents, it is proper, before we proceed to that part of the case, to notice the objections made to the second patent for the local circuits, which was originally obtained in 1846 and reissued in 1848.

It is certainly no objection to this patent, that the improvement is embraced by the eighth claim in the former one. We have already said that this claim is void, and that the former patent covers nothing but the first seven inventions specifically mentioned.

Nor can its validity be impeached upon the ground that it is an improvement upon a former invention, for which the patentee had himself already obtained a patent. It is true that, under the act of 1836, S. 13,

it was in the power of Professor Morse, if he desired it, to annex this improvement to his former specification, so as to make it from that time a part of the original patent. But there is nothing in the act that forbids him to take out a new patent for the improvement, if he prefers it. Any other inventor might do so; and there can be no reason, in justice or in policy, for refusing the like privilege to the original inventor. And when there is no positive law to the contrary, he must stand on the same footing with any other inventor of an improvement upon a previous discovery. Nor is he bound in his new patent to refer specially to his former one. All that the law requires of him is, that he shall not claim as new what is covered by a former invention, whether made by himself or any other person.

It is said, however, that this alleged improvement is not new, and is embraced in his former specification; and that if some portion of it is new, it is not so described as to distinguish the new from the old.

It is difficult, perhaps impossible, to discuss this part of the case so as to be understood by any one who has not a model before him, or perfectly familiar with the machinery and operations of the Telegraph. We shall not, therefore, attempt to describe minutely the machinery or its mode of operation. So far as this can be done intelligibly, without the aid of a model to point to, it has been fully and well done, in the opinion delivered by the learned Judge who decided this case in the Circuit Court. All that we think it useful or necessary to say is, that after a careful examination of the patents, we think the objection on this ground is not tenable. The force of the objection is mainly directed upon the receiving magnet, which, it is said, is a part of the machinery of the first patent, and performs the same office. But the receiving magnet is not of itself claimed as a new invention. It is claimed as a part of a new combination or arrangement to produce a new result. And this combination does produce a new and useful result. For by this new combination, and the arrangement and position of the receiving magnet, the local independent circuit is opened by the electric or galvanic current as it passes on the main line, without interrupting it in its course, and the intelligence it conveys is recorded almost at the same moment at the end of the line of the Telegragh and at the different local offices on its way. And it hardly needs a model or a minute examination of the machinery to be satisfied that a Telegraph which prints the intelligence it conveys, at different places, by means of the current as it passes along on the main line, must necessarily require a different combination and arrangement of powers from the one that prints only at the end. The elements which compose it may all have been used in the former invention, but it is evident that their arrangement and combination must be different to produce this new effect. The new patent for the local circuits was, therefore, properly granted, and we perceive no well-founded objection to the specification or claim contained in the reissued patent of 1848.

The two reissued patents of 1848, being both valid, with the exception of the 8th claim in the first, the only remaining question is, whether they, or either of them, have been infringed by the defendants.

The same difficulty arises in this part of the case which we have already stated in speaking of the specification and claims in the patent for

the local circuits. It is difficult to convey a clear idea of the similitude or differences in the two Telegraphs to any one not familiarly acquainted with the machinery of both. The Court must content itself, therefore, with general terms, referring to the patents themselves for a more special description of the matters in controversy.

It is a well-settled principle of law, that the mere change in the form of the machinery (unless a particular form is specified as the means by which the effect described is produced), or an alteration in some of its unessential parts, or in the use of known equivalent powers, not varying essentially the machine, or its mode of operation or organization, will not make the new machine a new invention. It may be an improvement upon the former, but that will not justify its use without the consent of the first patentee.

The Columbian (O'Rielly's) Telegraph does not profess to accomplish a new purpose or produce a new result. Its object and effect is to communicate intelligence at a distance, at the end of the main line and at the local circuits on its way. And this is done by means of signs or letters impressed on paper or other material. The object and purpose of the Telegraph is the same with that of Professor Morse.

Does he use the same means? Substantially, we think he does, both upon the main line and in the local circuits. He uses upon the main line the combination of two or more galvanic or electric circuits, with independent batteries, for the purpose of obviating the diminished force of the galvanic current, and in a manner varying very little in form from the invention of Professor Morse. And, indeed, the same may be said of the entire combination set forth in the patentee's third claim. For O'Rielly's can hardly be said to differ substantially and essentially from it. He uses the combination which composes the Register, with no material change in the arrangement, or in the elements of which it consists; and with the aid of these means he conveys intelligence, by impressing marks or signs upon paper; these marks or signs being capable of being read and understood by means of an alphabet, or signs adapted to the purpose. And as regards the second patent of Professor Morse, for the local circuits, the mutator of the defendant does not vary from it in any essential particular. All of the efficient elements of the combination are retained, or their places supplied by well-known equivalents. Its organization is essentially the same.

Neither is the substitution of marks and signs differing from those invented by Professor Morse any defence to this action. His patent is not for the invention of a new alphabet, but for a combination of powers composed of tangible and intangible elements, described in his specification, by means of which marks or signs may be impressed upon paper at a distance, which can there be read and understood. And if any marks, or signs, or letters are impressed in that manner, by means of a process substantially the same with his invention, or with any particular part of it covered by his patent, and those marks or signs can be read, and thus communicate intelligence, it is an infringement of his patent. The variation in the character of the marks would not protect it, if the marks could be read and understood.

We deem it unnecessary to pursue further the comparison between the machinery of the patents. The invasion of the plaintiff's rights, already stated, authorized the injunction granted by the Circuit Court, and so much of its decree must be affirmed. But for the reasons hereinbefore assigned, the complainants are not entitled to costs, and that portion of the decree must be reversed, and a decree passed by this Court, directing each party to pay his own costs in this and in the Circuit Court.

(To be continued.)

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

The U. S. Steamship-of-War Princeton, (2d.) By B. F. Isherwood, Chief Eng., U. S. N.

After the breaking up of the first *Princeton*, it was determined by the Navy Department to build another vessel of larger size, to be called by the same name, and to be propelled by the same engine, but with new boilers and a new screw. This second *Princeton* was constructed at the Charlestown, Mass., Navy Yard in 1851, and had the following dimensions of hull, machinery, &c.

Hull—

Length on deck,		178 feet.
Length of the mean load line from forward side of rabbet of stem to aft side of rabbet of post, at a mean draft of 19 feet 2 inches from the bottom of the keel,		175·7 feet.
Length of keel,		171 "
Extreme breadth,		32·88 "
" " at deck		32 "
Beam moulded,		32 "
Depth of keel forward,		1 foot 8 inches.
" " aft,		3 feet 10 "
" hold,		21 " 9 "
Height between berth and spar decks,		6 " 6 "
Deep load draft, with 500,000 pounds of coal on board, and all weights full,	forward,	18 "
	mean,	19 " 11 "
	aft,	21 " 10 "
Displacement at 19 feet 11 inches draft,		1485 tons.
" per inch of draft at 19 feet 11 inches draft,		10·93 "
Greatest immersed transverse section at 19 ft. 11 inches draft,		411 sq. feet.
With *one-third* the water, stores, provisions, fuel, &c., expended, the mean draft from bottom of keel is,		19 feet 2 inches.
At 19 feet 2 inches mean draft, the depth from water line to lower edge of rabbet of keel, is		16 " 5 "
Displacement, at 19 feet 2 inches mean draft,		1385 tons.
" per inch of draft, at 19 ft. 2 inches mean draft,		10·87 "
Greatest immersed transverse section, at 19 ft. 2 in. " "		387 sq. feet.
Displacement, exclusive of keel, at 19 ft. 2 in. mean draft,		48381 cub. feet.
Area of the load line, at 19 feet 2 inches mean draft,		4556·5 sq. feet.
Angle of clearance of mean load line, (19 ft. 2 inches mean draft,)		64°
Mean angle of clearance for the whole draft,		26°
Angle of entrance of mean load line,		57°
Mean angle of entrance for the whole draft,		34°
Angle of dead rise of the greatest transverse section,		22°

Area of mean load line in proportion to its circumscribing parallelogram,	0·784.
Displacement in proportion to circumscribing parallelopipedon (19 feet 2 inches draft,)	0·524.
Displacement in proportion to cylinder, having for base the greatest immersed transverse section, (19 feet 2 inches,)	0·712.
Area of greatest immersed transverse section in proportion to circumscribing parallelogram, (19 feet 2 inches draft,)	0·737.
Height of meta centre above centre of displacement,	6 feet 8 inches.
Centre of gravity of displacement before middle of the length of the load line,	4 " 4 "
Centre of gravity of displacement below the mean load line,	6 " 3 "
Distance of the greatest immersed transverse section before the middle of the length of the mean load line,	8 " 3 "
Centre of gravity of area of greatest immersed transverse section below the mean load line,	6 " 5 "
Area of immersed surface, exclusive of keel,	7370 sq. feet.
" surface on side and bottom of keel,	1130 " "

SAILS—(Full rigged ship.)

Surface of courses, topsails, topgallant sails, jib, and spanker,	13282 sq. feet.
Centre of effort before the centre of displacement,	3 feet 6 inches.
Height of the centre of effort above mean load line,	55 " 6 "
Surface of sail in proportion to area of mean load line,	2·91 to 1·00.
" " " " greatest immersed transverse section,	34·32 to 1·00.
Square feet of surface of sail in proportion to tons of displacement,	9·59 to 1·00.

Engines.—Two semi-cylindrical, direct acting, condensing engines, Ericsson's patent, with rectangular pistons vibrating through an arc of 90°. The engines are attached directly to the screw shaft, which makes one revolution for each double stroke of pistons. The steam valve is the same three-ported slide which was used in the first *Princeton*, but the cut-off valve is a "balance puppet," worked by Sickels' arrangement; this was substituted in place of the old *fixed* slide cut-off, with a view to have the rate of expansion adjustable at will.

Each semi-cylindrical cylinder is equivalent to a common cylinder, with a diameter of	57½ inches.
And a stroke of piston of	3 feet.
Space displacement of both pistons per stroke,	108·19 cubic feet.
Steam space between steam slide valves and pistons at *one* end of *both* cylinders,	10·36 " "
Steam space between steam slide and cut-off valves at one end of both cylinders,	3·00 " "

Screw.—One of bronze, placed in the stern of the vessel, between the stern-post and rudder-post. The propeller is a true screw radially, with an expanding pitch fore and aft. It makes one revolution for each double stroke of engines' pistons.

Diameter of screw,	16 feet.
" hub,	28 inches.
Initial pitch,	25 "
Final "	31 "
Mean " (from which the slip is calculated,)	28 "
Length of screw on hub in direction of axis,	2 "
Tapering to a length of screw at periphery in direction of axis,	3 " 6 inches.
Number of blades,	4.
Mean fraction used of the pitch,	0·4265.

Helicoidal area of the four blades,	115·44 square feet.
Projected area of the four blades on a plane at right angles to axis,	83·88 " "
Distance of the centre of the screw below the surface of the water at 19 feet 2 inches mean draft,	11 feet.
Finished weight of the screw,	15880 pounds.

Boilers.—Three iron tubular boilers, placed side by side, with one smoke chimney in common. The furnaces are arranged in two tiers, one above the other, with the tubes continued in a direct line beyond them. Opposite each furnace in the side boilers there are 23 tubes of 3½ inches external diameter, 18 tubes of 3 inches external diameter, and 1 tube of 2½ inches external diameter. Opposite each furnace of the middle boiler, there are 27 tubes of 3½ inches external diameter, 19 tubes of 3 inches external diameter, and 2 tubes of 2½ inches external diameter. All the tubes are 9 feet long, and contain in the aggregate 3757 square feet of heating surface.

Length of the boilers,	24 feet 5 inches.
Height of the boilers, (exclusive of steam chimney,)	9 " 8 "
Breadth of each side boiler,	7 "
Breadth of the middle boiler,	7 " 10 "
Area of the total grate surface in the three boilers,	213·7 square feet.
" " " heating surface " "	5130 " "
Aggregate cross area over the bridge walls,	18·000 " "
" " " of the tubes,	29·111 " "
" " " of the space between the bottom of the hanging bridge and the bottom of the boiler,	21·680 " "
Cross area of the smoke chimney,	37·122 " "
Height of the smoke chimney above grates,	51 feet.
Steam room in the three boilers,	580 cubic feet.
" " " and steam pipes,	678 " "
Weight of sea water in the boilers,	121,700 pounds.

PROPORTIONS.—

Proportion of heating to grate surface,	24·006 to 1·000.
" grate to area over bridge walls,	11·872 "
" grate surface to area of tubes,	7·341 "
" grate to area under hanging bridge,	9·857 "
" grate to area of smoke chimney,	5·757 "
Steam room in boilers and steam pipes per cubic foot of space displacement of piston per stroke,	6·27 cubic feet.
Steam room in boilers and steam pipes per cubic foot of steam used per stroke of pistons,	12·365 " "

Performance.—The following tables contain the performance of the *Princeton* (*2d*), as given by the log, and embraces *all* the steaming on the Coasts of Maine and Nova Scotia recorded. The performance is divided into two portions—that under steam alone being contained in one table, and that under steam and sail being contained in another. In the latter there frequently occurs what is termed negative slip of the screw, which is indicated by the minus (—) sign, showing what per centum of its own speed was the speed of the screw *less* than the speed of the vessel, the vessel in these cases being urged forward by a power independent of and additional to the screw. This negative slip never occurs with the vessel propelled by the screw alone.

With the Sickles cut-off, (subsequently removed,) it was found impossible to cut off, with the ordinary velocity of piston, at less than 0·40 of the stroke from the commencement; this was the minimum, and the cal-

culation of the evaporation of the boilers has been made for this point. The position of the throttle was such as to render it of scarcely any use, as it was situated in the steam pipe so far distant from the cylinder valves, that the section of pipe between contained one charge of steam when cutting off at 0·40 the stroke. The evaporation has been calculated for the temperature of feed water 100° F., and for the loss by "blowing off" sufficiently to maintain the sea water in the boiler at twice the natural concentration. Regnault's determination of the latent heat of steam is used. The fuel consumed was principally the Nova Scotia bituminous coal from the Pictou mines, with some mixture of anthracite. The remaining details will be found in the following tables:

Performance of the U. S. Steamship Princeton, (2d.) under Steam unassisted by Sail.

DATE. 1853.	Consecutive hours.	Speed of the vessel per hour, in knots of 6082⅔ feet.	Course of the Vessel.	WIND. Direction.	WIND. Kind.	State of the Sea.	Slip of the screw in per centums of its speed.	ENGINES. Steam press. in boilers in lbs pr sq. in. ab. atm.	ENGINES. Revolutions made by the screw per min.	ENGINES. Pounds of coal consumed per hour.
July 24	5	6·800	N. E.	S. or on quarter.	Light breeze.	Sm'th.	16·26	16·4	29·40	1586
" 28	6	7·375	E.	E. or ahead.	"	"	8·72	15·7	29·25	1925
" 29	8	6·400	—	On bow.	"	"	3·45	9·7	24·00	2741
Aug. 3	16	7·383	S.	S. W. or on bow.	"	"	10·33	15·6	29·81	2397
" 4	17	7·235	—	On quarter.	"	"	8·76	13·0	28·71	2264
" 16	2	7·250	E. S. E.	S.W. or ab'ft bm.	"	"	7·90	16·5	28·50	1576
" 17	9	6·990	E.	W. or aft.	"	"	8·80	14·8	27·75	1769
					WIND.					
" 20	5	6·350	N. W.	N. W. or ahead.	Moderate	Mod'ate	22·59	21·8	29·70	2072
" 24	6	7·083	N. N. W.	E. or abaft beam.	Light	Smooth.	14·51	19·5	30·00	2322
" 29	3	6·167	S. E.	S. S. E. or ahead.	Moderate	Mod'ate	23·88	15·7	29·33	1657
" 29	6	6·400	—	Abaft the beam.	"	Smooth.	3·45	11·0	24·00	1178
" 30	4	5·062	N. W.	W. or on bow.	"	"	8·36	8·1	20·00	1383
Sep. 1	18	6·360	N. N. W.	N. or on bow.	Fresh.	Mod'ate.	13·65	14·6	26·17	1870
" 2	12	6·104	—	Ahead.	"	"	13·90	14·6	25·67	1890
" 3	17	5·386	S. S. E.	S. or ahead.	Strong.	Rough.	27·13	16·2	26·76	2238
" 11	16	4·700	N. W.	N. W. or ahead.	"	H'vy hd.	29·27	17·4	23·22	1970
" 12	24	5·808	N. N. W.	" "	Fresh.	Mod'ate.	14·90	19·4	24·71	2037
" 17	12	7·500	W. S. W.	S. W. or ahead.	Light.	Smooth.	3·02	19·1	28·00	2151
" 23	2	6·250	N. W.	N. by W. or ahead.	Moderate	"	3·70	15·0	23·50	2205
" 24	12	5·880	N. W.	N. W. or ahead.	"	"	7·44	14·5	23·00	1943
Means,		6·331					13·24	15·9	26·42	2026

Performance of the U. S. Steamship Princeton, (2d,) under Steam assisted by Sail.

DATE. 1853.	Consecutive hours.	Speed of the vessel per hour, in knots of 6082¾ feet.	Sail set.	Course of the vessel.	WIND. Direction.	WIND. Kind.	State of the Sea.	Slip of the screw in per centums of its speed.	ENGINES. Steam press. in boilers in lbs pr sq in. ab. atm.	ENGINES. Revolutions made by the screw per min.	ENGINES. Pounds of coal consumed per hour.
July 28	11	6·863	*	E.N.E.	S. W. or aft.	Light breeze.	Sm'th.	—2·93	13·3	28·54	1734
Aug 17	3	8·183	†	N. E.	WS.W. or aft.	Fresh breeze.	"	—3·34	14·2	28·67	1285
" 17	4	8·687	†	E.byN.	S. W. or aft.	"	"	—14·38	13·0	27·50	1455
Sep. 11	3	8·500	‡	S. W.	N. or on quar.	"	Heavy.	—9·91	12·0	28·00	1376
" 13	3	6·920	§	—	Abeam.	"	Mod'ate.	+6·04	17·3	26·67	2053
" 13	8	7·562	†	N. E.	W. or on quar.	Light breeze.	Sm'th.	—3·32	16·4	26·50	1927
" 18	15	8·467	*	WbyS.	S. or abeam.	Strong wind.	Mod'ate.	—7·40	19·5	28·54	2200
" 22	6	6·317	*	S. by E.	E. or abeam.	Light breeze.	Smooth.	+11·46	18·2	25·83	2338
§ " 23	12	7·271	*	"	N. E. or on qr.	Moderate breeze.	Mod'ate.	—2·56	13·6	25·67	1990
" 23	10	7·386	*	—	On quarter.	"	Sm'th.	—1·68	15·5	26·30	2184
Means,		7·567						+0·26	15·7	27·47	1963

* All sail. † Studding sail. ‡ To topsails. § Fore and aft.

Condition of the Engines, &c.—During the steaming recorded in the foregoing tables, the metallic packings of the vibrating pistons of the engines were in a very bad condition, leaking steam freely. It appears from a late overhauling of the engines at New York, that the packing on the top of the pistons, comprising about one-third of their periphery, had not only never been tight, but had always had a *clear space* between the metallic packing bar and the cylinder. This of course operated not only a great loss of steam, but it also decreased the power of the engines by a portion of the steam passing continually from the steam side of the pistons to the condensers. One of the vibrating pistons was also found loose on its shaft. The calculated evaporation in the following "Summary," does not include this loss, which of course could only be estimated. That calculation is made from the number of cylinders full of steam used; the real evaporation would necessarily be higher, probably about a quarter pound of steam per pound of coal; as I find the boilers of the *Allegheny*, precisely like the *Princeton's*, and of the same size, evaporated under the same conditions 6·516 pounds of steam per pound of coal. The *Princeton's* and *Allegheny's* boilers consumed the same weight of coal per hour, and as the temperature of the smoke pipe of the latter, within the steam pipe or drum that surrounded it, was 450° Fah., it may be concluded that the temperature of the *Princeton's* was the same.

The same kind of boiler as the *Princeton's* is in present use in a number of British war-steamers; it was originally introduced into the United States for steamers by Robert L. Stevens, of Hoboken, N. J., who put it, in 1837, in the Steamboat *Independence*, plying between South Amboy,

N. J., and New York. This boiler burned anthracite with a fan blast; it was of copper, and made by R. H. Dunham & Co., of New York; it gave general satisfaction. By referring back to the evaporation given by the boilers of various steamers recorded in the pages of this Journal, it will be seen that, with the exception of the boilers of the Collins Steamers, the *Princeton's* boiler gave a full average evaporation per pound of coal.

The stuffing boxes of the engine piston shafts leaked so badly as greatly to impair the vacuum, which could not be maintained at an average of more than 22 inches of mercury in the condenser, giving a very great back pressure on the piston.

Summary of the Performance of the U. S. Steamship Princeton, (2d,) from July 24, to September 24, 1853, on the Coasts of Maine and Nova Scotia, embracing all the steaming recorded in the Logs.

	Under steam unassist'd by sail.	Under steam assisted by sail.	Mean of total steaming with and without sail.
OBSERVED.			
Total number of hours,	200	75	275
Speed of the vessel per hour in knots of 6082¾ feet,	6·331	7·567	6·668
Steam pressure in boilers in lbs. per sq. in. above atmos.,	15·9	15·7	15·85
Steam pressure in cylinders in lbs. per sq. in. above atm.,	12	10	11·46
Double strokes of pistons (and revolutions of the screw) per minute,	26·42	27·47	26·71
Steam cut off at from commencement of stroke of pistons,	0·40	0·40	0·40
Back pressure in condensers in lbs. per square inch,	2.7	2·7	2·7
Pounds of coal burned per hour,	2026	1963	2009
Tons of coal burned per 24 hours,	21·70	21·03	21·52
Mean draft of vessel in feet and inches,	19 6	19 6	19 6
Immersion of centre of screw below surface of water in feet and inches,	11 4	11 4	11 4
Greatest immersed transverse area in square feet,	397	397	397
Displacement of the hull in tons,	1428	1428	1428
State of the sea,	Moderate.	Moder'ly smooth.	—
State of the wind,	Moderate on bow.	Moder'ly fresh on quarter.	—
CALCULATED.			
Slip of the screw in per centums of its speed,	13·24	0·26	9·61
Mean effective pressure on pistons in lbs. per sq. inch,	13·8	12·2	13·37
Horses power developed by the engines,	344·27	316·45	337·21
Pounds of coal burned per hour per square foot of grate surface,	9·481	9·186	9·401
Pounds of coal burned per hour per square foot of heating surface,	0·395	0·383	0·392
Cubic feet of steam of atmospheric pressure furnished per minute from sea water of twice the natural concentration, with temperature of feed water 100° Fahr., inclusive of loss by blowing off to maintain that concentration, and of loss between valves and pistons, and in steam ports,	—	—	5690·92
Pounds of steam evaporated per hour from one square foot of heating surface, under the above conditions,	—	—	2·447
Pounds of steam evaporated per hour by one pound of coal, under the above conditions,	—	—	6·248

The following figures will show a tolerably correct idea of the relative proportions of the vessels. The engines were the same in both.

Comparison between the First and Second Princetons.

	First Princeton.	Second Princeton.
HULL.		
Mean draft of the vessel from the bottom of the keel, with *one-third* the fuel, water, provisions, &c., expended,	16 ft. 1½ in.	19 ft. 2 ins.
Depth of the hull from the above water line to lower edge of rabbet of keel,	14 "	16 " 5 "
Displacement at above draft,	954 tons.	1385 tons.
Weight of the hull,	418 "	650 "
Displacement per inch of draft at above draft,	9·17 "	10·87 "
Length of the hull on above water line,	153 ft. 8½ in.	175·7 feet.
Extreme breath of hull on water line,	30 "	32·88 "
Greatest immersed transverse section at above draft,	338 sq. feet.	387 sq. feet.
Area of the load line at above draft,	3740 8 "	4556·5 "
Height of meta centre above centre of displacement,	7 feet.	6 ft. 8 in.
Centre of gravity of displacement before the middle of the length of the load line,	3 ft. 11½ in.	4 " 4 "
Centre of gravity of displacement below the mean load line,	5 " 4½ "	6 " 3 "
Distance of the greatest immersed transverse section before the middle of the length of the mean load line,	7 " 1¾ "	8 " 3 "
Centre of gravity of area of greatest immersed transverse section below the mean load line,	8 " 1½ "	6 " 5 "
Angle of dead rise for the greatest transverse section,	13°	22°
Angle of entrance of mean load line,	80°	57°
Mean angle of entrance for the whole draft,	36°	34°
Angle of clearance of mean load line,	78°	64°
Mean angle of clearance for the whole draft,	43°	26°
Displacement in proportion to circumscribing parallelopipedon,	0·525	0·524
Displacement in proportion to cylinder, having for base the greatest immersed transverse section,	0·634	0·712
Area of greatest immersed transverse section in proportion to circumscribing parallelogram,	0·804	0·737
Area of mean load line in proportion to circumscribing parallelogram,	0·811	0·784
Total immersed surface of hull in square feet,	6820	8500
SCREW.		
Diameter,	14·25 feet.	16 feet.
Pitch,	32·44 "	28 "
Kind of pitch,	Regular.	Expanding fore & aft from 25 to 31 feet.
Number of blades,	6	4
Area of helicoidal surface,	176·71 sq. ft.	115·44 sq. ft.
Area of projected surface on a plane at right angles to axis,	113·52 "	83·89 "
BOILERS.		
Aggregate breadth,	21 feet.	21 ft. 10 in.
Length,	26 "	24 " 5 "
Height, exclusive of steam chimney,	9 ft. 4 ins.	9 " 8 "

Performance of the Princeton (2d,) in smooth water, uninfluenced by wind.—The following performance is what can be steadily sustained in the smooth water of a Bay, uninfluenced by wind, and was determined

from runs in Chesapeake Bay, where the distances were accurately known. The vessel being at a mean draft of 19½ feet.

Speed of the vessel per hour in knots of 6082¾ feet, .	8·037.
Double strokes of engine pistons (and revolutions of screw) per minute,	30.
Mean effective pressure on pistons in pounds per square inch,	17.
Horses power developed by the engines, .	481·57.
Slip of the screw (calculated for mean pitch of 28 feet) in per centums of its speed, . . .	3.

If, for this performance, the friction of the engines, *per se*, be taken at 1·25 pounds per square inch when making 30 double strokes, which, from experiments on other engines, I believe to be very near the truth, the co-efficient for the friction of the load at 7½ per cent. according to Morin's determination, and the friction on the screw surface on the water be taken the same as determined from the screw of the "Charlemagne" in the February number of this Journal, viz.: at 0·7796 pound per square foot of helical surface, moving in its helical path with a velocity of 10 feet per second, we shall obtain the following disposition of the power:

	H. Power.	Per Cent.
Expended in overcoming friction, &c., of the engines,	35·41	or 7·35
" " " of the load, .	36·12	7·50
" " " of the screw surface, &c., on the water,	39·23	8·15
" in the slip of the screw, . .	11·13	2·31
" in propelling the simple hull, .	359·68	74·69
Total, . . .	481·57	100·00

From the above, we find that (74·69+2·31=) 77 per centum of the total power was applied to the screw, and 77 per centum of the mean effective pressure, 17 pounds, is 13·09 pounds per square inch of piston. The area of the two pistons is 5193·44 square inches, and the double stroke of pistons is 6 feet; the thrust of the screw will therefore be

$$\frac{5193{\cdot}44\times13{\cdot}09\times6}{28}=14568 \text{ pounds.}$$

During the above performance, the anterior edge of the screw (25 feet pitch) had a *negative* slip of 8·64 per centum, but the posterior edge (31 feet pitch) had a *positive* slip of 12·39 per centum, showing, that with the pitch properly expanded in the fore and aft direction of the screw, the posterior portion of the screw blade can be made to act proportionally in a very efficient manner. It may be supposed, as some of the anterior portion of the blade (one-sixth of the whole blade) had a less speed than the vessel, and carried a sea before it, that the carrying of this sea caused a waste of power; such, however, is not the case; for as pressure and resistance are equal and in opposite directions, whatever power was bestowed on the water carried in front of the screw, the same was regained by the resistance of this water acting in the direction of turning the screw propulsively. The screw, however, was intended for ocean navigation, where with a moderate sea and a moderate wind on the bow, it gave the following results, viz:

PERFORMANCE OF THE PRINCETON 2D AT SEA WITHOUT SAIL.

Speed of the vessel per hour in knots of 6082¾ feet, .	6·331.
Double strokes of engine pistons (and revolutions of the screw) per min.	26·42.
Mean effective pressure on pistons in pounds, per sq. inch. .	13·8.

Horses power developed by the engines, .	344·27.
Slip of the screw (calculated for its mean pitch of 28 feet) in per centums of its speed, . . .	13·24.

Proceeding as before, we obtain the following disposition of the power, viz.:

	H. Power.		Per Cent.
Expended in overcoming the friction, &c. of the engines,	27·47	or	7·98
" " " of the load,	25·82		7·50
" " " of screw surface, &c., on the water,	26·80		7·79
" in the slip of the screw, . .	34·98		10·16
" in propelling the simple hull, .	229·20		60·77
Total, . . .	344·27		100·00

From the above, we find that (60·77+10·16=) 70·93 per centum of the total power was applied to the screw, and 70·93 per centum of the mean effective pressure, 13·8 pounds, is 9·79 pounds per square inch of pistons. Proceeding as before, we have, then, for the thrust of the screw $\left(\frac{5193{\cdot}44\times 9{\cdot}79\times 6{\cdot}}{28}=\right)$ 10895 pounds.

Increased resistance of the vessel from a moderate head sea and wind, over the resistance in smooth water, uninfluenced by wind.—The power required to drive the vessel in smooth water, uninfluenced by wind, at the speed of 8·037 knots per hour, was 359·68 horses power, which for the speed of 6·331 knots per hour, would become ($8{\cdot}037^3 : 359{\cdot}68 :: 6{\cdot}331^3 :$) 175·79 horses. For this speed of 6·331 knots per hour against a moderate head sea and wind, we have seen that a power of 359·68 horses was required; the resistance of the hull has, therefore, been increased $\left(\frac{359{\cdot}68}{175{\cdot}79}=\right)$ 2·044 times.

Comparison of the Performances of Princetons 1st and 2d, at sea, without sail, and against moderate head seas and wind.—The most satisfactory comparison of the performances of these vessels, will doubtless be at sea under the ordinary condition of things found there when steaming alone; and for that purpose there will be selected the performance of *Princeton* **1st**, with Stevens' screw, for the whole period during which she was commanded by Captain Engle, and under the above conditions of weather. The results thus obtained, being the mean of many thousand observations, noted by different watch officers in the ship's official log, can doubtless be depended on, and are as accurate as such results can ever be determined. The abstract of these logs can be found on page 107 of the August number, 1853, of this *Journal*. The mean results for 1099 hours steaming in the Gulf of Mexico, the Mediterranean, and Atlantic Ocean, are as follows, viz:

Speed of the vessel per hour in knots of 6082¾ feet, .	6·172.
Double strokes of engine pistons (and revolutions of screw) per minute,	24·064.
Mean effective pressure on pistons in pounds, per sq. inch, .	10·47.
Horses power developed by the engines, .	237·9.
Slip of the screw in per centums of speed, . .	19·85.

Proceeding as in the former cases, we obtain the following disposition of the power, viz:

	H. Power.		Per Cent.
Expended in overcoming the friction, &c., of the engines,	21·62	or	9·09
" " " of the load,	17·84		7·50
" " " of screw surface on the water,	30·20		12·69
" in the slip of the screw, . .	33·40		14·04
" in propelling the simple hull, .	134·84		56·68
Total, . . .	237·90		100·00

From the above, we find that $(56{\cdot}68+14{\cdot}04=)$ 70·72 per centum of the total power was applied to the screw, and 70·72 per centum of the mean effective pressure, 10·47 pounds, is 7·404 pounds per square inch of pistons. Proceeding as before, we have for the thrust of the screw, $\left(\frac{5193{\cdot}44\times 7{\cdot}404\times 6.}{32{\cdot}44}=\right)$ 7112 pounds.

With the *Princeton* 2*d*, there was required to propel the simple vessel against moderate head seas and winds, at the rate of 6·331 knots per hour, 229·20 horses power, for the speed of 6·172 knots per hour; this would become $(6{\cdot}331^3 : 229{\cdot}20 : : 6{\cdot}172^3 :)$ 212·34 horses power; and as the *Princeton* 1*st* required only 134·84 horses power for the same speed, under the same conditions, it follows that the resistance of the *Princeton* 2*d* was $\left(\frac{212{\cdot}34}{134{\cdot}84}=\right)$ 1·575 times greater than that of the *Princeton* 1*st*.

For the Journal of the Franklin Institute.

The "Iron Ridge" and Ore Beds of Dodge County, Wisconsin. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. TURNBULL.

(Continued from page 270.)

During the last three years, these deposits have attracted much notice, partly on account of the interesting and anomalous character of the ore, and partly because of the great practical value of a bed thus situated. "The Wisconsin Iron Company" has the credit of making the first experiment upon this ore; and, in fact, of erecting the first, and at present the only stack furnace in Wisconsin. The same enterprising gentlemen, who were the pioneers in iron manufacture in the State of Indiana, where they erected the "Mishawaukie Furnace," upon the bog ores near the Michigan line, have directed their skill, capital, and energy, to the same interest in the State of Wisconsin. Their works at Maysville, in Dodge county, are driven by water, and consume the ore of the "Iron Ridge," which is hauled on sleds in winter, about four and a half miles. The geological position of this ore has not been determined with precision. Mr. Lapham, of Milwaukie, has traced the formations to the eastward of the boundaries of Dr. Owen's survey of 1839, in places as far as Lake Michigan; but the fossils are so few, and so much of the surface of the country mantled by deposits of drift, concealing the rocks, and the limestones possessing lithological or external characters so little marked and so little diverse at distant points, and their stratification so poorly

defined, that it is very difficult to form a good opinion of the order of the strata.

According to Mr. Lapham, of Milwaukie, the lower sandstone formation extends into Dodge County, at the north-west corner and south-west corner; and the "Lower magnesian limestone" is seen through the western part of the country resting upon this sandstone. Fig. 1.

In the south-west part of the country, the "Blue limestone" is clearly developed. After passing an interval of four or five miles to the eastward of the latter formation, the "Upper magnesian" or lead-bearing limestone is visible, having a breadth of about six miles; the eastern observed limit being six miles to the west of Rock River, on the south line of the country. These rocks all dip easterly.

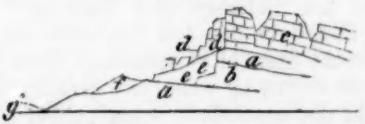
Passing now over to the lake-shore near Milwaukie, Mr. Lapham found the succession of rocks taken in the reverse order as follows:

1. Corniferous limestone.
2. Geodiferous lime-rock of Eaton.
3. Next beneath the geodiferous, is a heavy bed of limestone, which Mr. Lapham calls, as a temporary name, the "Waukeshaw Limestone."

The Waukeshaw limestone, like the geodiferous and the corniferous, which overlie it, dips to the east. It appears in the south-east part of Dodge County, leaving an undetermined space between its western outcrop and the eastern presentation of the upper magnesian or lead-bearing lime-rock of about two townships or twelve miles. It is in this interval, but doubtless in the same formation, that the iron ore occurs. It appears in the face of a bluff, looking westward, and running nearly north and south, parallel with that portion of Rock River, between Horicon and Hustisville, and about four miles east of the river.

It exists on the surface in small *flattened oblong grains*, like flaxseed, but only about half as large, with a bright brownish red color, inclining in streaks to black or bluish black, with an unctuous, greasy, magnesian feel; soils the fingers and clothes badly, and gives a light blood-red tinge to water flowing through it when newly dug. Farther down in the mass, where it has not been disturbed by deluvial forces, it is darker in color, more compact, distinctly stratified, and occasionally stony. The following section of the "Iron Ridge," was taken at Mr. Theodore B. Sterling's steam saw-mill, Section 13, T. 11 North Range, 16° east of 4th Principal Meridian, the course being east and west:

70 Feet.



c, Bluff of cavernous limestone, from which springs issue.
aa, Hidden from view.
b, Exposed stratified ore.
ee, Excavation.
dd, Large blocks of limestone.
f, Material removed.
g, Coarse drift.

The base of this section is the spring, at the spring-house, a few rods

east of Mr. Sterling's dwelling-house, which Mr. S. estimates at thirty feet above the surface of the dam at Hustisville, which is two hundred and ninety-five feet above Lake Michigan. The elevation of the spring above the river is probably greater than is here given.

An excavation, *e e*, has been made through the rubbish of the bluff to the ore in place, where a face of fifteen and a half feet is exposed.

It was not practicable by inspection to determine the limit of the ore below the bottom of the cut *e e*, although an iron bar had been thrust down four or five feet without reaching any other deposit. On the upper face, judging from the shattered and tumbling state of the overlaying lime-rock, there should be from five to eight feet of ore, or some soft stratum above the exposed portion. If this conjecture be true, there are at least twenty-five feet of the ore in place.

Passing along the bluff to the southward, it inclines to the east, and shows red ochre for more than half a mile, in some places on the same level, at others higher up the hill, especially where it takes a more regular slope and the cliff is not seen. From the crest of the bluff, at the section, the level descends to the eastward, and ochre covers the lime-rock like soil or deluvium. To the northward, the same appearances are observed, and at about three-quarters of a mile, where the Wisconsin Iron Company take out their ore, the hill appears to be all ore for sixty feet in height. The surface ore is here mined almost as readily as sand or loose earth, only stripping the soil and taking out the roots that are intermingled with it. The overlying limestone at Sterling's is a granular grey variegated whitish and yellowish limestone that makes good lime. The analysis of the Sterling ore by Professor J. L. Cassels, of Cleveland, Ohio, indicates over 53 per cent. of iron, which is as follows:

Peroxide of iron,	76·74	53·72 iron. 23·02 oxygen.
Sesquioxide of manganese,	1·05	
Clay,	4·00	
Silex,	10·00	
Water,	6·00	
Loss,	2·21	
	100·00	

The Wisconsin Iron Company, under the management of John Niles, Esq., use the ore without burning, and find it to melt very easy without flux; in fact, it has been found necessary to introduce silex, in the shape of water-washed sand, to retard the process of melting and thus improve the quality of the metal. In November, 1849, their charge consisted of fifty-five pounds of bog ore, sixty-six pounds of sand, thirty-five pounds of limestone, and six hundred and sixty pounds of the ochery ore unburnt. The yield with a moderately hot blast, was thirty-five to forty-two per cent. of iron; the furnace running out three and a half to four tons of metal per day, of twenty-four hours, with a consumption of one hundred and forty-five to one hundred and fifty-five bushels of charcoal per ton. The castings made from this iron are smooth, and the sound and texture of the metal was good, but seemed to be less tough than other castings. The manager was about to try the effect of cold blast on the quality of the iron.

*Process for Printing copies of Plants, Materials, Lace, &c., from the originals, styled ("Naturselbstdruck") Natural Printing Process,**

Under this term, Louis Auer, of the Imperial Printing Office at Vienna, has patented a process invented by himself in conjunction with Mr. Andrew Worring, overseer of the same establishment, "for creating, by means of the original itself, in a swift and simple manner, plates for printing copies of plants, materials, lace, embroideries, originals or copies, containing the most delicate profundities or elevations not to be detected by the human eye," &c. A pamphlet giving a description of this discovery and a series of specimens has reached us. The examples consist of an impression from a fossil fish, from agates, the leaves of trees, several plants, mosses, algæ, and the wing of a bat. These are all printed in the natural color of the objects they represent; and it is difficult to conceive anything more real than these productions. The general character of the process is told in the following pithy manner by Louis Auer, in the introductory paragraphs of his pamphlet:—

"*Query*—How can, in a few seconds, and almost without cost, a plate for printing be obtained from any original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.? —*Solution*—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies,—with its whole surface, as it were,—on the lead plate. If the colors are applied to this stamped lead plate, as in printing a copperplate, a copy in the most varying colors, bearing a striking resemblance to the original, is obtained by means of *one single* impression of each plate. If a great number of copies are required, which the lead-form, on account of its softness, is not capable of furnishing, it is stereotyped, in case of being printed at a typographical press, or galvanized in case of being worked at a copperplate press, as many times as necessary, and the impressions are taken from the stereotyped or galvanized plate instead of from the lead plate. When a copy of a unique object, which cannot be subjected to pressure, is to be made, the original must be covered with dissolved gutta percha; which form of gutta percha, when removed from the original, is covered with a solution of silver to render it available for a matrix for galvanic multiplication."

This process is also applicable to the purpose of obtaining impressions of fossils, or of the structure of an agate or other stone. In all the varieties of agate, the various layers have different degrees of hardness; therefore, if we take a section of an agate, and expose it to the action of fluoric acid, some parts are corroded, and others not. If ink is at once applied, very beautiful impressions can be at once obtained; but for printing any number, electrotype copies are obtained. These will have precisely the character of an etched plate, and are printed from in the ordinary manner. The silicious portions of fossil and the stone in which they are imbedded may in like manner be acted upon by acid; and from these either stereotyped or electrotyped copies are obtained for printing

* From the London Athenæum, December, 1853.

from. We learn that Mr. Bradbury, of the firm of Bradbury & Evans, has availed himself of this invention, and that he is now preparing a series of Botanical specimens for publication,—so that, very shortly, the public will be in possession of examples of this beautiful process. It is not a little singular that the workers in German silver and Britannia metal, at Birmingham, have for some time been in the habit of ornamenting the surfaces of these metals by placing a piece of lace, no matter how delicate, between two plates, and passing these betwen rollers. In this way every fibre is most faithfully impressed upon the metal. We are not aware, however, that any attempts to print from these impressions have yet been made at Birmingham. The value set on the invention by the author may be judged by the following paragraph:—

"Russia has given up Jacobi's application of the Galvanoplastik in the year 1837, and France the Daguerreotype for general use in the year 1839; Austria has now furnished a worthy pendant to these two inventions."

On the Consumption of Smoke.—Experiments with Jukes's Patent Furnace.

By Mr. A. Fraser.*

The author stated that it was not intended to enter on the various theories which have been advanced on the subject, or to discuss the many inventions before the public, still less to bring forward any new theory, but to give the "results of absolute work," in a successful attempt to remove the smoke nuisance from an extensive London brewery and its neighborhood. Messrs. Truman, Hanbury, Buxton, & Co. had tried most of the plans which previous to 1847 gave reasonable hopes of success. In 1847 the writer's attention was first drawn to Jukes's patent furnace, which consisted of a strong cast-iron frame of the full width of the furnace, and about three feet longer. The fire bars were all connected together, forming, when complete, an endless chain, and were made to revolve round a drum, placed at each end of the frame. The front of the frame was provided with a hopper, in which the fuel was placed, and a furnace door, which opened vertically with a worm and pinion. The height to which this door was raised by the stoker, regulates the supply of coal, which was carried into the fire by the gradual motion of the bars. This plan was first applied to an engine boiler—a cylindrical one, with two tubes—driving a 40-horse power engine; and having been successful, it was adapted to a second boiler of the same kind. In the same year the probability of its success under a brewing copper was discussed. There was no doubt, from the former experiments, as to its capabilities for raising steam or for evaporation; but with a brewing copper provision had to be made for a process in the manufacture almost peculiar to it. The contents of the copper have to be turned out several times in the course of a brewing, rendering it necessary to "bank up" the fire thoroughly, to protect the bottom of the copper, until refilled with wort or water. It was feared that the machinery would interfere with this being done effectually: it was tried, and with the same success as with the steam boilers. The remainder of the coppers and boilers were afterwards altered. The total cost of the

* From the London Athenæum, December, 1853.

fourteen furnaces, including brickwork, had been about 3000*l.* The consumption of coals in the establishment was 6000 tons per annum. The saving in the coal account, since the introduction of the patent to July 1st of the present year, had been 8338*l.*, from which must be deducted for casualties, and sundries, say 350*l.* The above economy had not arisen from less weight of fuel consumed, but owing to the screenings or dust of coal only being required for the furnaces. It would appear at first sight that the wear and tear of a machine, apparently so complicated, must exceed the expense of the common fixed bars. This, however, had not been found to be the case, and it need not be so if ordinary care were given to the machine, and a periodical examination such as any other machine of equal value and producing equally important results would receive. Within the last week a set of bars, which had been in use since May, 1849, had been renewed, for the first time; and three-fourths of the old bars were being again used for another furnace, where the boiler was of less importauce than the one from which they have been removed.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Adelaide.

New York.—Hull built by Lupton & McDiarmid, Greenpoint, L. I. Machinery by Neptune Iron Works. Intended service, San Francisco.

HULL.—	
Length on deck,	245 feet.
Breadth of beam, moulded, at midship section,	33 "
Depth of hold,	9 " 6 inches.
Length of engine and boiler space,	72 "
Draft of water at load line,	5 "
Draft of water at below pressure and revolutions,	5 "
Masts and rig—Foretopsail schooner.	
ENGINE.—One—Vertical beam.	
Diameter of cylinder,	50 inches.
Length of stroke,	12 feet.
Maximum pressure of steam in pounds,	40
Cut off at half stroke.	
Maximum revolutions per minute,	23
BOILER.—One—Return flued.	
Length of boiler,	32 feet.
Breadth "	13 " 6 inches.
Height " exclusive of steam chimney,	11 " 8 "
Number of furnaces,	3
Length of grate bars,	8 "
Number of flues,	10 below, 6 above.
Internal diameter of flues,	17 inches in upper flues.
Diameter of smoke pipe,	61 inches.
Height "	28 feet.
WATER WHEELS.—	
Diameter of water wheel,	32 feet.
Length of blades,	8 " 6 inches.
Depth "	24 "
Number "	24

Remarks.—Guards forward; floor timbers at throats *moulded* 15 inches, *sided* 5 and 6 inches; distance of frames apart *at centres*, 22 inches. Blower to furnace.

For the Journal of the Franklin Institute.

Particulars of the Steamer (Not named.)

New York.—Hull built by Jacob A. Westervelt & Son. Machinery by Morgan Iron Works. Intended service, Pacific.

HULL.—

Length on deck,		264 feet.	
Breadth of beam moulded,		36 "	
Depth of hold,	17 feet 3 in. and	24 "	6 inches.
Length of engine and boiler space,		66 "	
Draft of water at load line,		9 "	6 "
" " below pressure and revolutions,		9 "	6 "
Contents of bunkers in tons of coal.	550		
Masts and rig—Forctopsail schooner.			
Tonnage, (custom-house),	1653		

ENGINES—Two—vertical beam.

Diameter of cylinder,			50 inches.
Length of stroke,		10 feet.	
Maximum pressure of steam in pounds,	22		
Cut off at half stroke.			
Maximum revolutions per minute,	18		

BOILERS—Two—single return flued.

Length of boilers,		30 feet.	
Breadth "		13 "	
Height " exclusive of steam chimney,		12 "	
Number of furnaces	6		
Length of grate bars,		7 "	
Number of flues or tubes,	28		
Internal diameter of flues or tubes,	16, 15, 13, and 10 inches.		
Diameter of smoke pipe,		6 feet	9 "
Height "		42 "	
Description of coal,	Bituminous.		
Consumption of coal per hour,	1 ton.		

PADDLE WHEELS.—

Diameter of water wheel,		30 feet.	
Length of blades,		9 "	
Depth "			16 inches.
Number "	28		

Remarks.—Guards fore and aft—Hull strapped with diagonal and double laid iron braces, $4\frac{1}{2} \times \frac{5}{8}$. Floor timbers at throats, *moulded*, 16 inches; *sided*, 14. Distance of frames apart *at centres*, 28 inches. Draft of boilers, natural.

Electro-Deposition of Aluminium and Silicium. By GEORGE GORE, Esq.*

Enclosed are two specimens of sheet copper, one coated with metallic aluminium and the other with silicium, by electro-deposition process; and if the following simple statement of the manner in which they were obtained is worthy of a place in your Magazine, I shall be happy to have it published.

To obtain the aluminium, I boiled an excess of dry hydrate of alumina in hydrochloric acid for one hour, then poured off the clear liquid, and added to it about one-sixth of its volume of water; in this mixture I placed an earthen porous vessel containing one measure of sulphuric acid to twelve

*From the Lond., Edinb., and Dublin Philosoph. Magazine, March, 1854.

measures of water, with a piece of amalgamated zinc plate in it. In the chloride of aluminium solution I immersed a piece of copper of the same amount of immersed metallic surface as that of the zinc, and connected it with the zinc by means of a copper wire, and set it aside for several hours; when on examining it, I found it coated with a lead color deposit of aluminium, which when burnished possessed the same degree of whiteness as platinum, and did not appear to tarnish readily by immersion in cold water or in the atmosphere, but was acted upon by sulphuric or nitric acids, either concentrated or dilute.

I found that if the apparatus was kept quite warm, and a copper plate much smaller than the zinc plate was used, the deposit appeared in a very short time, in several instances in less than half a minute. Also I found that if the chloride solution was not diluted with water, the deposit was equally, if not more rapid.

I have also succeeded in obtaining a quick deposit of aluminium in a less pure state by dissolving ordinary "pipe clay" in boiling hydrochloric acid, and using the supernatant clear solution undiluted with water in the place of the before mentioned liquid. A similar deposit of aluminium was also obtained from a strong aqueous solution of acetate of alumina; likewise from a saturated aqueous solution of ordinary "potash alum," but rather slowly; with each of the solutions named, the deposit was hastened by putting either one, two, or three small Smee's batteries in the circuit.

To obtain the deposit of silicium, I dissolved monsilicate of potash (formed by fusing together 1 part of silica with $2\frac{1}{4}$ parts of carbonate of potash) in water, in the proportion of 40 grs. to 1 oz. measure of water, proceeding in like manner as with the alumina solutions, the process being hastened by interposing one pair of small Smee's battery in the circuit. With a very slow and feeble action of the battery, the color of the deposited metal was much whiter than that of the aluminium, closely approximating to that of silver; its other properties I have not yet had time to examine.

8 *Broad Street, Birmingham, February* 24, 1854.

On Aluminium and its Compounds. By M. Deville.*

It is known that Wöhler obtained the metal aluminium in the state of a powder by treating the chloride with potassium. By a suitable modification of Wöhler's process, the decomposition of the chloride of aluminium can be regulated so as to produce a temperature sufficient for the particles of the metal to agglomerate into globules. If the mass composed of the metal and chloride of sodium (sodium is preferable to potassium) is exposed to a bright red heat in a porcelain crucible, the excess of chloride of aluminium is expelled, and there is left a saline mass with an acid reaction in which are disseminated more or less large globules of perfectly pure aluminium.

This metal is as white as silver, and in the highest degree malleable and ductile. When wrought, however, it exhibits greater resistance, and its tenacity probably approaches that of iron. It is hardened by

* From the London, Edinburgh, and Dublin Philos. Magazine, March, 1854.

hammering, but reacquires its softness on being reheated. Its fusing-point differs but slightly from that of silver; its specific gravity = 2·56; it can be melted and cast without being perceptibly oxidized; it is a good conductor of heat. It is not in the least affected by moist or dry air, does not tarnish, but remains bright by the side of zinc and tin freshly cut, which soon become dull. Sulphuretted hydrogen has no action upon it, cold water does not alter it, boiling water does not tarnish it. It is not acted upon by nitric acid, weak or strong, or by weak sulphuric acid, employed cold. Its true solvent is hydrochloric acid, with which it forms chloride of aluminium. Heated to redness in hydrochloric acid gas it furnishes dry volatile chloride of aluminium.

It will be readily understood what important uses such a metal, which is white and unalterable like silver, which does not blacken in the air, is fusible, malleable, ductile and tenacious, and has in addition the singular property of being lighter than glass, may be turned to if it can be obtained readily. This I have every reason to believe will prove to be the case, for the chloride of aluminium is decomposed with remarkable ease by the common metals at an elevated temperature; and a reaction of this kind, which I am attempting to carry out on a large scale, will solve this question in a practical point of view.—*Comptes Rendus*, Feb. 6th, 1854.

For the Journal of the Franklin Institute.

Particulars of Steamer Cahawba.

New York.—Hull built by William Collyer. Machinery by Allaire Works. Owners, New York and Alabama Steamship Company. Intended service, New York and Mobile, via Havana.

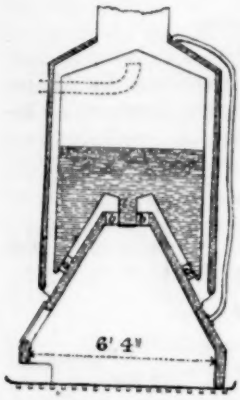
HULL.—			
Length on deck,	260	feet.	
Breadth of beam at midship section,	37	"	
Depth of hold,	19	"	6 inches.
Length of engine space,	78	"	
Draft of water at load line,	17	"	
Masts and rig— Barque.			
Tonnage, (custom-house,) 1713			
ENGINE.—One—vertical beam.			
Diameter of cylinder,			75 inches.
Length of stroke,	11	feet.	
BOILERS—Two—return flued.			
Length of boilers,	31	feet	9 inches.
Breadth "	12	"	6 "
Height " exclusive of steam chimney,	11	"	6 "
Number of furnaces in each boiler, 3.			
Length of grate bars,	8	"	
Diameter of smoke pipe,	6	"	4 "
Height "	42	"	
Description of coal, Bituminous and Anthracite.			
WATER WHEELS.—			
Diameter of water wheel,	31	feet.	
Length of blades,	8	"	6 inches.
Depth "			16 "
Number of blades, 28.			

Remarks.—Floor timbers at throats, *moulded* 15½ inches; *sided* 14½ inches. Distance of frames apart *at centres*, 29 inches.

For the Journal of the Franklin Institute.

The Bee-Hive Boiler of Lake Erie. By Thomas Drew Stetson.

The steam navigation of the lakes of North America is distinguished by the occasional employment of a form of boiler, locally known by several different appellations, among which the "bee-hive" is, perhaps, the most strikingly descriptive. The accompanying sketch is designed to represent a vertical section through the whole structure, and also through a "water jacket," with which the larger sizes are invariably provided, and which may be considered, in fact, as it certainly is in effect, a part and parcel of the boiler. The boiler proper is in two portions, one above the other, with suitable connexions, to allow a free circulation of the contents. A connexion is made by a copper pipe leading from the topmost point of the jacket to a position near the base of the main shell, down which the full heated water and a small modicum of steam is assumed to be continually flowing. This pipe is the only means of communication. The check-valve, not shown in the sketch, is attached to the jacket near its lower rim, and although the vessels are rarely propelled with independent feed pumps of any description, the arrangement renders it practically certain that this important appendage will remain at all times nearly or quite filled with water. There are four connexions, *a a*, located at equidistant points in the horizontal plane. The connexions, *b b*, are two in number, and serve to convey the current of steam and highly heated water from the lower into the upper shell, while the lower and more liberal passages may be supposed, in some cases at least, to convey a current in opposite direction. It may be sufficient to know, however, that the deposit, in all cases, settles to the bottom of the lower shell, at which point, as well as at the lower edge of each of the outer portions, ample provision is made for its removal. In the fresh clear water of the lakes, these boilers have been uniformly successful, and although difficult of repairs, may very naturally be inferred from the novelty of the form, and the whole might be, for various theoretical considerations, pronounced necessarily short-lived and troublesome, the experience of the few years it has been in use, seems to indicate a rather unlooked-for durability, and the style has won itself a degree of local popularity which might, perhaps, be more widely extended.



The boiler of the propeller *Troy*, from which the sketch is prepared, has been now more than three years in service without any expenditure for repairs.

The *Boston*, a small propeller of some 16 inch cylinder, running between Cleveland and Ogdensburgh, was the first on which this boiler was adopted, and the repairs have, to this day, cost about $250·00. The whole credit of the experiment is due to Mr. L. Parmalee, a boiler-

maker, of Cleveland, by whom most or all of this description yet in use have been constructed. The heating surface is somewhat more efficient than the same extent in any of the usual forms, the actual evaporation being taken as the index. The boiler of the *Troy* presents about 700 square feet of fire surface, and 31½ of grate area. This supplies plenty of very dry steam at a pressure of 80 lbs. above atmosphere, to a cylinder 3 feet 6 inches stroke, and 28 inches diameter, making 55 revolutions per minute, and cutting off at ⅝-ths of the stroke from commencement, the throttle being always wide open.

The boiler of the *Troy* having been constructed when the material was quoted at a much lower figure, the cost would be no data for comparison. A boiler now building in this form, and of almost precisely similar dimensions, is to cost $2250. The form and proportions allow a very considerable fluctuation in the water level, without exposing any surfaces to the direct action of the fire, and the large unobstructed water surface allows, what is rarely obtained in upright boilers, tolerably perfect separation of the vapor from the water, the per centage of water mechanically suspended, being, for obvious reasons, much less than in any of the ordinary forms. The steam is withdrawn from a point near the apex of the upper shell, the pipe bending down and coming out through the side, as indicated by the dotted lines.

Clothing with felting, or other non-conductors, is a refinement not yet introduced to any considerable extent, either on these or other steam boilers in those localities. Under all the circumstances, with natural draft and ordinary firing with hard wood, the results in several propellers most readily accessible, are as follows, the steam in every case being represented as "plenty" at a pressure of from 68 to 80 lbs.; throttle valve never used:

The *Niagara*, with a fire surface of 575 square feet, a grate surface of 28·3, and a cylinder 3 feet 6 by 22 inches, makes 56 revolutions, cutting off at ⅔ths.

The *Forest Queen*, fire surface 537, cylinder 3 feet 6 by 28½, makes 56 revolutions, cutting off at ½.

The *Westmoreland*, (a fine propeller, 200 feet in length,) fire surface 710, grate 44, cylinder 3 feet 6 by 28 inches, makes 58 revolutions, cutting off at ⅔.

The *Prairie State*, *Michigan*, and *Ogdensburgh*, each presenting 700 feet of heating surface, and 38½ feet grate area, with cylinders 3 feet 6 inches stroke, and 22 inches diameter, make from 54 to 60 revolutions, loaded, cutting off respectively at ½, ⅝, and ½ stroke.

The consumption of fuel in the furnaces of these boilers, which are termed "conical vertical," in the Official Reports of the Inspectors, are recorded as follows:—

Niagara,	wood,	consumption,	¾	cord	per hour.
Forest Queen,	"	"	⅞	"	"
Westmoreland,	"	"	1	"	"
Boston,	"	"	¾	"	"
Prairie State,	"	"	1	"	"
Michigan,	"	"	¾	"	"
Ogdensburgh,	"	"	¾	"	"

There are now floating on the waters of Lake Erie, eleven or more of these boilers. The water spaces adopted, are uniformly 4 inches thick around the furnaces. The water jackets are somewhat thinner at the base, diminishing to only about two inches thickness at the top. The iron is

⅝-ths of an inch thick for the principal boilers, and ½-th inch for the jacket, stayed every 5½ inches. Water bottoms can probably be fitted without difficulty, but are not yet much employed, the bottom being usually a simple water pan supported on plain bars about two inches square.

This bottom affords a trifle less direct protection to the keelsons, but gives free access to water in case of accident, and allows a fire to make itself apparent in less time than does a brick bed. The size of the boiler now in use, ranges, in external dimensions, from 4 feet 6 inches, to 7 feet 4 inches, and in perpendicular height, from 10 to 17 feet. Its use is unobstructed by patent, or any "intention" to monopolize whatever advantages it may be found to possess.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 20, 1854.

Samuel V. Merrick, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Two letters from the Royal Institution of Great Britain, London, were read.

Donations to the Library were received from The Royal Institution of Great Britain; The Royal Institute of British Architects; The Royal Geological Society, London; George Wallis, Esq., Birmingham, England; Hon. G. W. Manypenny, Commissioner of Indian Affairs; Hon. James Cooper, Hon. Joseph R. Chandler, U. S. Congress; Messrs. Gould & Lincoln, Boston, Mass; J. S. Dodge, Esq., Oriskany, N. Y.; The Managers of the State Lunatic Asylum of the State of New York; Chas. Corghi, City New York; M. W. Baldwin, Esq., Pennsylvania Legislature; J. Horrock, Esq., Frankford, Penna.; and Edward Miller, Esq., Dr. L. Turnbull, The Pennsylvania Institution for the Instruction of the Blind, Wm. H. Hazzard, Esq., and Messrs. Lindsay & Blakiston, Philadelphia.

Donation to the Cabinet of Minerals and Geological Specimens, from George Schall, Esq., Mount Carmel, Penna.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for March, was read.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Instruction, reported that, $ 440·25 were received from 79 pupils in the Drawing School of the Institute, during the Session, 1853–4, just closed.

The Actuary reported the organization of the following Standing Committees by the election of their chairmen, and appointing the time for holding their stated meetings, viz:

Committees.	*Chairmen.*	*Meetings.*
On Meteorology,	J. A. Kirkpatrick,	First Monday.
" Minerals, &c.,	J. C. Trautwine,	Second Monday.
" Arts and Manufactures,	Prof. J. C. Booth,	Second Tuesday.

Resignations of membership (6,) in the Institute, were read, and accepted.

New Candidates for membership in the Institute (8) were proposed, and those candidates proposed at last meeting (2), were duly elected.

Dr. Rand exhibited a new form of repeating pistol, known as Leonard's patent. The barrels, five in number, are fixed, the cones are in the axes of the barrels, and the caps are exploded by a revolving hammer, which is concealed in the stock of the weapon. The hammer is drawn back and caused to turn one-fifth of a revolution by a trigger, and discharged by a second trigger in front of that used for cocking. These are so arranged, that the pistol may be cocked and fired with one hand, and if both are drawn back at once, it does not cock, so that an accidental discharge is impossible. The mechanism by which the hammer is caused to revolve is highly ingenious, but cannot be explained without a drawing.

Dr. Rand also exhibited Porter's repeating rifle, in which there is a single barrel and a number of chambers arranged around the circumference of a vertical disk. These chambers are loaded, brought in succession to the barrel, and discharged.

Dr. Hare exhibited his instruments, called "cycloidographs," with numerous interesting and complicated designs produced by them. Dr. Hare noticed the applications of these curves to the purposes of industrial design, as well as to the whirlwind theory of storms.

Mr. Wm. D. Parrish gave the following account of an explosion which occurred on the Mississippi River.

The Kate Kearny exploded at St. Louis in February last. I was on board before and after the explosion. She had 4 cylinder boilers lying abreast in front of the wheel houses, 40 inches diameter, each having two return flues 14 inches diameter, made in the usual form with cast iron heads; the iron of the case was about $\frac{1}{4}$ inch thick, and the heads $1\frac{1}{4}$ inch thick; they were all supplied with water by a doctor placed aft the boilers, which forced the water through a horizontal pipe communicating with the bottom of each. She had two high pressure inclined engines, one on each side the boat. Her larboard boiler burst with great violence just as she was backing out of her berth early in the morning, making a complete wreck of every thing front of the wheel houses and destroying a number of lives. The force of the explosion appeared to take a downward direction, throwing the front of the boiler upward, also flattening and bending the flues, and throwing fragments of them back on the engine with their front ends turned towards the stern. Portions of the boiler were thrown several hundred yards, damaging the fronts of large stores as high as the fourth story. Very little of the boiler was left on board. The rents were not confined to the lines of rivets, but took an irregular course through the sheets. From the best information I could obtain at the time, the explosion was caused by a deficiency of water; it was supposed the supply pipes were frozen, and the doctor did not act till near the time of the accident.